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Final Environmental Impact Statement/Report and 4(f) Statement

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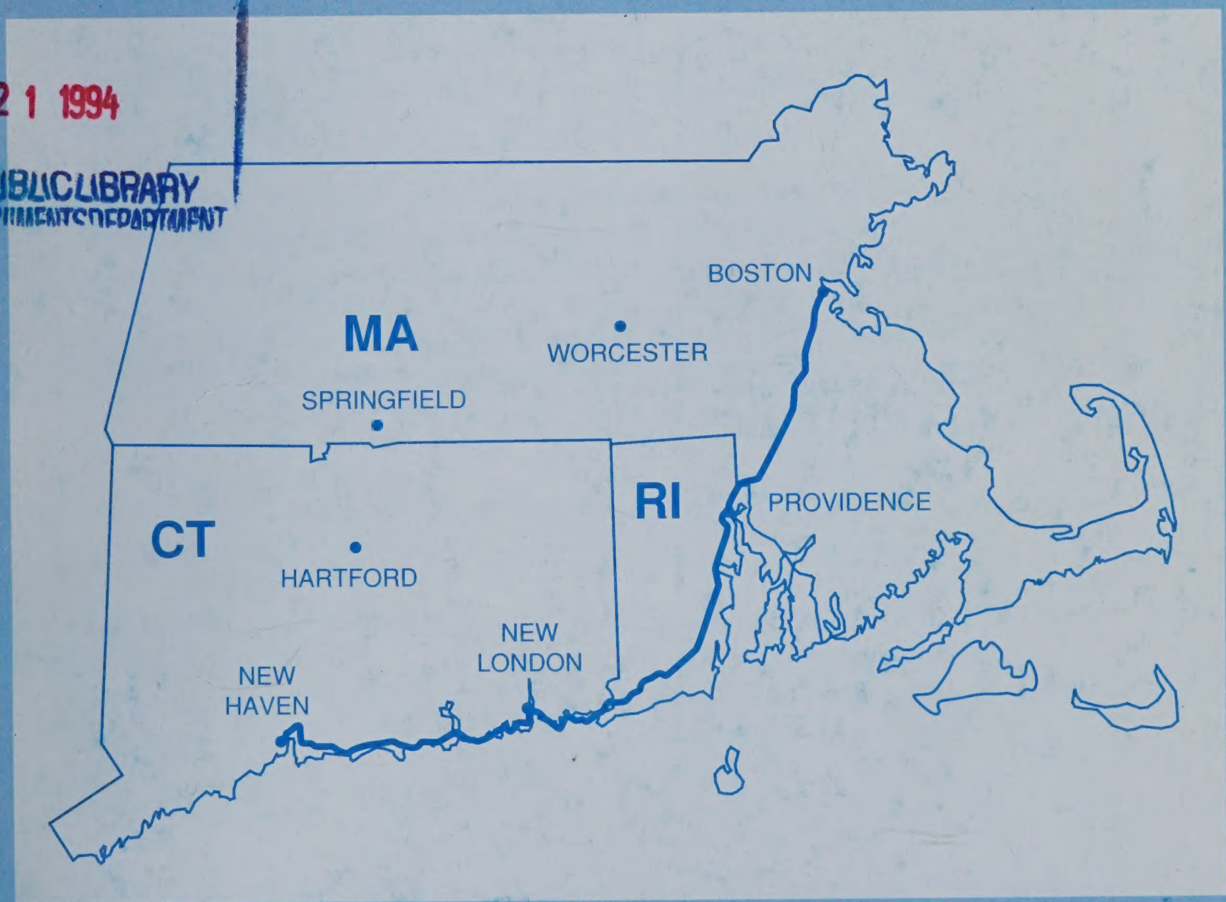
Northeast Corridor Improvement Project Electrification - New Haven, CT to Boston, MA



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October 1994

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FINAL ENVIRONMENTAL IMPACT STATEMENT/REPORT
and 4(f) Statement
NORTHEAST CORRIDOR IMPROVEMENT PROJECT - ELECTRIFICATION
NEW HAVEN, CT - BOSTON, MA

U.S. Department of Transportation
Federal Railroad Administration
Office of Railroad Development

October 31, 1994
DATE

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13. ABSTRACT (Maximum 200 words)

This document is the final environmental impact statement and final environmental impact report (FEIS/R) on the proposal by the National Railroad Passenger Corporation (Amtrak) to complete the electrification of the Northeast Corridor main line by extending electric traction from New Haven, CT., to Boston, MA. This FEIS/R supplements the draft document published in October 1993 and made available for public comment through January 21, 1994. Comments received on the Draft EIS/R have been reviewed and evaluated. In some cases design refinements were made, additional analyses were performed and further explanations of potential impacts were incorporated into the FEIS/R as a result of those comments.

This FEIS/R presents a comprehensive assessment of the consequences of each project alternative on the natural, physical and social environment. Environmental consequences are identified and, where possible, quantified. Mitigation measures that will reduce or eliminate potential adverse impacts are also identified. The FEIS/R consists of four volumes. This document (Volume I) is the main body of the FEIS/R and includes a 4(f) Statement on the proposed location of an electrification facility in the Great Swamp Wildlife Management Area. Volume II presents additional technical studies to supplement Volume III of the DEIS/R issued in October 1993. Volume III of the FEIS/R presents summaries of comments received on the DEIS/R and responses to these comments. Volume IV reprints the comments received on the DEIS/R.

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PREFACE

This document is the final environmental impact statement and final environmental impact report (FEIS/R) on the proposal by the National Railroad Passenger Corporation (Amtrak) to complete the electrification of the Northeast Corridor main line by extending electric traction from New Haven, CT, to Boston, MA.

This FEIS/R has been prepared by the Federal Railroad Administration (FRA) and the John A. Volpe National Transportation Systems Center (VNTSC) of the Research and Special Programs Administration through a contract with the joint venture of Daniel, Mann, Johnson and Mendenhall, Inc., and Frederic R. Harris, Inc. (DMJM/Harris).

This FEIS/R supplements the draft document published in October 1993 and made available for public comment through January 21, 1994. Comments received both in writing and at a number of public hearings have been reviewed and evaluated. In some cases design refinements were made, additional analyses were performed, and further explanations of potential impacts incorporated into the FEIS/R as a result of those comments.

This FEIS/R presents a comprehensive assessment of the consequences of each project alternative on the natural, physical and social environment. Aspects of the natural environment addressed include noise, vibration, energy, air quality, aesthetics and natural or ecological resources. The physical environment includes land use, electromagnetic fields and interference, and archaeological resources. The social environment includes socioeconomics, historic resources, public safety, and transportation. Environmental consequences are identified and, where possible, quantified. Mitigation measures that will reduce or eliminate potential adverse impacts are also identified. Based on these factors, the environmental impact of each alternative was assessed.

Draft Record of Decision

Based on the analysis contained in the FEIS/R and other relevant considerations, FRA has selected the project proposed by Amtrak as modified by appropriate measures to mitigate adverse impacts as FRA's preferred alternative.

The executive summary of this FEIS/R includes the draft Record of Decision by the FRA regarding its decision in selecting the preferred alternative. The final Record of Decision will be issued by FRA no sooner than 30 days after the release of this FEIS/R.

Organization of the FEIS/R

This FEIS/R consists of four volumes. Volume I is the main body of the FEIS/R. Volume II presents additional technical studies to supplement Volume III of the DEIS/R issued in October 1993. Volume III of the FEIS/R presents summaries of comments received on the DEIS/R and responses to these comments. Volume IV reprints the comments received on the DEIS/R.

METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in) = 2.5 centimeters (cm)

1 foot (ft) = 30 centimeters (cm)

1 yard (yd) = 0.9 meter (m)

1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2 = 6.5 square centimeters (cm^2)

1 square foot (sq ft, ft^2 = 0.09 square meter (m_2)

1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)

1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)

1 acre = 0.4 hectares (he) = 4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gr)

1 pound (lb) = .45 kilogram (kg)

1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)

1 tablespoon (tbsp) = 15 milliliters (ml)

1 fluid ounce (fl oz) = 30 milliliters (ml)

1 cup (c) = 0.24 liter (l)

1 pint (pt) = 0.47 liter (l)

1 quart (qt) = 0.96 liter (l)

1 gallon (gal) = 3.8 liters (l)

1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)

1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

[(x-32)(5/9)] °F = y °C

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)

1 centimeter (cm) = 0.4 inch (in)

1 meter (m) = 3.3 feet (ft)

1 meter (m) = 1.1 yards (yd)

1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2

1 square meter (m^2) = 1.2 square yeards (sq yd, yd

1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)

1 hectare (he) = 10,000 square meters (m^2) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gr) = 0.036 ounce (oz)

1 kilogram (kg) = 2.2 pounds (lb)

1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

VOLUME (APPROXIMATE)

1 milliliters (ml) = 0.03 fluid ounce (fl oz)

1 liter (l) = 2.1 pints (pt)

1 liter (l) = 1.06 quarts (qt)

1 liter (l) = 0.26 gallon (gal)

1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)

1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)

TEMPERATURE (EXACT)

[(9/5) y + 32] °C = x °F

QUICK INCH-CENTIMETER LENGTH CONVERSION

INCHES	0		1		2		3		4			5		6		7			8		9		10
CENTIMETERS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	25.40

QUICK FAHRENHEIT-CELSIUS TEMPERATURE CONVERSION

°F	-40°	-22°	-4°	14°	32°	50°	68°	86°	104°	122°	140°	158°	176°	194°	212°
°C	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°

For more exact and or other conversion factors, see NBS Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50. SD Catalog No. C13 10286.

Final Environmental Impact Statement/Report and 4(f) Statement

Northeast Corridor Improvement Project Electrification - New Haven CT to Boston MA

Volume I

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION:
PURPOSE AND NEED 1-1

1.1 PURPOSE AND NEED FOR THE FEIS AND FEIR 1-1

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION 1-2

1.3 DESCRIPTION OF THE PROPOSED ACTION 1-3

1.4 PROJECT BACKGROUND 1-4

1.4.1 History and Status of the Northeast Corridor 1-4
1.4.2 History of the Northeast Corridor Improvement Project 1-5
1.4.3 Current Status of the Northeast Corridor Improvement Project 1-6
1.4.4 Other Site-Specific NECIP Projects 1-6

1.5 RELEVANT PARTIES 1-10

1.6 DESCRIPTION OF THE CORRIDOR 1-11

1.7 DIFFERENCES BETWEEN THE FEIS/R AND DEIS/R 1-12

1.8 ORGANIZATION OF THE FEIS/R 1-12

CHAPTER 2
DEVELOPMENT AND DESCRIPTION OF ALTERNATIVES 2-1

2.1 INTRODUCTION 2-1

2.2 SUMMARY OF THE 1978 PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT 2-2

2.2.1 Non-Rail Alternatives 2-2
2.2.2 New Technologies 2-3
2.2.3 Traction Power Alternatives 2-4
2.2.4 Route Alternatives 2-7
2.2.5 Overall Conclusion 2-16

2.3 ALTERNATIVES RAISED IN THE SITE-SPECIFIC DEIS/R SCOPING PROCESS 2-18

2.3.1 Screening Criteria 2-18
2.3.2 Non-Electrification Alternatives 2-18
2.3.3 Electrification Alternatives 2-20

2.4 ALTERNATIVES ANALYZED IN THIS FEIS/R 2-23

2.4.1 No-Build Alternative 2-23
2.4.2 Amtrak's Electrification Project 2-28

CHAPTER 3
AFFECTED ENVIRONMENT 3-1

3.1 LAND USE 3-1

3.1.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-1
3.1.2 Affected Environment 3-2

3.2 SOCIOECONOMICS 3-5

3.2.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-5
3.2.2 Affected Environment 3-6

3.3 HISTORIC RESOURCES 3-9

3.3.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-9
3.3.2 Affected Environment 3-10

3.4 NOISE AND VIBRATION 3-11

3.4.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-11
3.4.2 Affected Environment 3-12

3.5 ELECTROMAGNETIC FIELDS AND INTERFERENCE 3-14

3.5.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-14
3.5.2 Affected Environment 3-14

3.6 ENERGY 3-16

3.6.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-16
3.6.2 Affected Environment 3-17

3.7 ARCHAEOLOGY 3-18

3.7.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-18
3.7.2 Affected Environment 3-19

3.8 PUBLIC SAFETY 3-20

3.8.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-20
3.8.2 Affected Environment 3-20

3.9 TRAFFIC, TRANSPORTATION, AND CIRCULATION 3-23

3.9.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-23
3.9.2 Affected Environment 3-23

3.10 AIR QUALITY 3-29

3.10.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-29
3.10.2 Affected Environment 3-32

3.11 VISUAL AND AESTHETIC RESOURCES 3-34

3.11.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-36
3.11.2 Affected Environment 3-36

3.12 NATURAL RESOURCES 3-40

3.12.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines 3-40
3.12.2 Affected Environment 3-44

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES AND CONSTRUCTION PERIOD IMPACTS 4-1

4.1 LAND USE 4-2

4.1.1 Benefits 4-2
4.1.2 Impacts 4-3

4.2 SOCIOECONOMICS 4-3

4.2.1 Benefits 4-4
4.2.2 Impacts 4-5

4.3 HISTORIC RESOURCES 4-10

4.3.1 Impacts 4-11

4.4 NOISE AND VIBRATION 4-15

4.4.1 Evaluation Criteria 4-15
4.4.2 Methods of Analysis 4-17
4.4.3 Benefits 4-19

	4.4.4 Impacts	4-20
4.5	ELECTROMAGNETIC FIELDS AND INTERFERENCE	4-28
	4.5.1 Summary of Studies and Research Findings	4-28
	4.5.2 Evaluation Criteria	4-31
	4.5.3 Impacts	4-31
4.6	ENERGY	4-37
	4.6.1 Benefits	4-37
	4.6.2 Energy Impacts	4-37
4.7	ARCHAEOLOGY	4-44
	4.7.1 Method of Analysis	4-45
	4.7.2 Impacts	4-45
4.8	PUBLIC SAFETY	4-46
	4.8.1 Impacts	4-46
4.9	TRANSPORTATION, TRAFFIC AND CIRCULATION	4-54
	4.9.1 Projected 2010 Intercity Service and Ridership	4-54
	4.9.2 Benefits	4-60
	4.9.3 Impacts	4-61
4.10	AIR QUALITY	4-81
	4.10.1 Benefits	4-81
	4.10.2 Impacts	4-85
4.11	VISUAL AND AESTHETIC EFFECTS	4-93
	4.11.1 Visually Sensitive Receptors	4-93
	4.11.2 Impacts	4-95
	4.11.3 Architecturally Sensitive Areas	4-101
4.12	NATURAL RESOURCES	4-104
	4.12.1 Methods of Analysis	4-104
	4.12.2 Impacts	4-106
4.13	HAZARDOUS MATERIAL AND SOLID WASTE	4-112
	4.13.1 Methods of Analysis	4-112
	4.13.2 Impacts	4-113

CHAPTER 5
MITIGATION AND PERMIT REQUIREMENTS 5-1

5.1 MITIGATION OF ADVERSE IMPACTS OF THE PROPOSED ACTION 5-1

5.1.1 Corridorwide Mitigation Requirements 5-1
5.1.2 Site-Specific Mitigation 5-12

5.2 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY 5-21

5.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES 5-21

5.4 FEDERAL AND STATE ENVIRONMENTAL PERMITS REQUIRED 5-22

LIST OF ABBREVIATIONS

GLOSSARY OF TERMS

APPENDIX A ELECTRIFICATION FACILITIES AND BRIDGE MODIFICATIONS

APPENDIX B TABLES FOR CHAPTER 3

APPENDIX C PUBLIC PARTICIPATION/MEPA CERTIFICATE

APPENDIX D MEMORANDUMS OF AGREEMENT

APPENDIX E LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS FROM WHOM COMMENTS WERE RECEIVED ON THE DEIS/R

APPENDIX F LIST OF PREPARERS AND REVIEWERS

APPENDIX G SECTION 4(F) STATEMENT FOR SITING OF THE KINGSTON PARALLELING STATION

APPENDIX H LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS RECEIVING THE FEIS/R

APPENDIX I KEY CORRESPONDENCE

APPENDIX J SITING ANALYSIS FOR CONNECTICUT SUBSTATION ALTERNATIVES

APPENDIX K SITING ANALYSIS FOR ROXBURY SUBSTATION ALTERNATIVES

LIST OF TABLES

CHAPTER 1

1.1-1 Northeast Corridor Transportation Plan 1-7

CHAPTER 2

2.2-1 Metropolitan Area Population: Shore Line vs. Inland Route (1975 - 1990) 2-9
2.2-2 Physical Characteristics of Alternate Routes 2-10
2.2-3 Airline Route by Status, Ownership, and Track Class 2-17
2.3-1 Preliminary Alternatives Considered 2-22
2.4-1 Electrification Facility Sites 2-33
2.4-2 Bridge Undercutting Locations 2-39
2.4-3 Bridge Modifications 2-40
2.4-4 Summary of Electrification Alternative 2-40

CHAPTER 3 [See Appendix B]

3.1-1 Facility Zoning B-1
3.1-2 Land Uses Adjacent to the Northeast Corridor Rail Line by Municipality (within 1/2 mile either side of ROW) B-2
3.1-3 Prime and Important Farmland Soil Types B-6
3.2-1 Employment by Industry in the Project Corridor B-8
3.2-2 Census Tract Information B-9
3.2-3 Facility and Economic Data of Marine-Related Businesses at the Five Moveable Bridges B-10
3.3-1 Status of Historic Resources in the Project Area - Connecticut B-11
3.3-2 Status of Historic Resources in the Project Area - Rhode Island B-14
3.3-3 Status of Historic Resources in the Project Area - Massachusetts B-19
3.4-1 Summary of Existing Noise Measurement Results B-22
3.4-2 Existing Ground Vibration Measurement Summary B-23
3.5-1 Population Categories Potentially Exposed to Project-Induced EMF B-24
3.7-1 Environmental Attributes Contributing to Prehistoric Archaeological Sensitivity Rankings B-26
3.7-2 Locational Attributes Contributing to Historic Period Site Distribution B-26
3.7-3 Archaeological Sensitivity of Substation Sites and Utility Corridor B-27
3.7-4 Archaeological Sensitivity of Switching Station Sites B-27
3.7-5 Archaeological Sensitivity of Paralleling Station Sites B-28
3.7-6 Archaeological Sensitivity at Bridges to be Modified B-29
3.8-1 Characteristics of Existing Grade Crossings B-30
3.8-2 Pedestrian Crossings in Connecticut B-31
3.8-3 Pedestrian Crossings in Rhode Island B-32
3.8-4 Pedestrian Crossings in Massachusetts B-32
3.8-5 Station Characteristics and Pedestrian Access at Railroad Stations B-33
3.9-1 Existing Boston-New York City Amtrak Service on the Northeast Corridor via Shore Line B-35
3.9-2 Existing Annual Amtrak and Commuter Ridership at Express Stations B-36
3.9-3 Daily Railroad Freight Operations B-37
3.9-4 Existing Level of Service at Critical Intersections B-38
3.9-5 Existing Amtrak-Generated Parking Demand at Railroad Stations B-38

LIST OF TABLES (Continued)

3.9-6 Location and Characteristics of Proposed Bridge Modifications B-39
3.9-7 Roadway Characteristics and Average Existing Delay of Vehicles per Train Event at Grade Crossings with Automatic Gates B-40
3.9-8 Moveable Bridge Summary B-41
3.9-9 Railroad Movements, Typical Weekday, 1993 B-41
3.9-10 Moveable Bridge Operations, 1993 B-42
3.10-1 Federal and State Ambient Air Quality Standards B-43
3.10-2 1991 Monitoring Results for the Project Corridor B-44
3.10-3 Sources of Existing Emissions (tons/day) B-45
3.10-4 Existing Project-Related VOC Emissions in the NEC by State (kg/day) B-45
3.10-5 Existing Project-Related NO_X Emissions in the NEC by State (kg/day) B-46
3.10-6 Existing Project-Related CO Emissions in the NEC by State (kg/day) B-46
3.10-7 Existing Project-Related SO_2 Emissions in the NEC by State (kg/day) B-47
3.10-8 Estimated Maximum 1992 Baseline 8- and 1-Hour CO Concentrations at the Intersection of University Avenue and Blue Hill Drive B-48
3.10-9 Estimated Maximum 1992 Baseline 8- and 1-Hour CO Concentrations at the Intersections of Blue Hill Drive and Route 128 South Ramps B-49
3.11-1 Visual Modification Determinations For Visually Sensitive Receptors B-50
3.12-1 Occurrence of Natural Resources on Substation Sites and Power Line Corridors B-53
3.12-2 Occurrence of Natural Resources on Switching Station Sites B-54
3.12-3 Occurrence of Natural Resources on Paralleling Station Sites B-55
3.12-4 Occurrence of Natural Resources at Bridges to be Modified B-57
3.12-5 Occurrence of Natural Resources at Moveable Bridge Cable Crossings B-58

CHAPTER 4

4.1-1 Land Use Evaluation Criteria 4-2
4.2-1 Socioeconomic Evaluation Criteria 4-4
4.2-2 Estimated Number of Permanent Amtrak Positions Resulting from the Proposed Action 4-5
4.3-1 Historic Resources Evaluation Criteria 4-12
4.3-2 Historic Railroad Bridges Potentially Adversely Affected 4-12
4.3-3 Overhead Roadway and Pedestrian Bridges Potentially Adversely Affected 4-13
4.3-4 Historic Properties Potentially Adversely Affected 4-14
4.4-1 Noise and Vibration Evaluation Criteria 4-15
4.4-2 Proposed FTA Noise Impact Criteria 4-16
4.4-3 Proposed FTA Vibration Impact Criteria 4-17
4.4-4 Corridorwide Train Noise Impact Inventory 4-24
4.4-5 Potential Noise Impacts from Electrification Facilities 4-25
4.4-6 Corridorwide Train Vibration Impact Inventory 4-26
4.4-7 Potential Construction Noise Impacts 4-27
4.4-8 Potential Construction Vibration Impacts 4-28
4.5-1 Evaluation Criteria for EMF Emissions 4-33
4.5-2 Comparison of Estimated EMF Exposure Levels with Interim Guidelines 4-34
4.6-1 Evaluation Criteria for Energy Impacts 4-37
4.6-2 Summary of Projected Energy Consumption, Proposed Action, 2010 4-39
4.6-3 Summary of Energy Consumption of Trains by Alternative 4-41

LIST OF TABLES (Continued)

4.6-4 Total Fossil Fuel Consumption in 2010 for all Modes of Intercity Travel in the NEC 4-42
4.6-5 Alternative Fuel Mix Analysis 4-43
4.6-6 Potential Additional Energy Consumptions From Trucks 4-44
4.7-1. Evaluation Criteria for Impacts on Archaeological Resources 4-45
4.8-1 Evaluation Criteria for Public Safety Impacts 4-46
4.8-2 Probability of Rail-Vehicular Collisions at Grade Crossings (in collisions per year) 4-49
4.8-3 Maximum Allowable Speed (MAS), 1991 and 2010, New Haven to Boston 4-50
4.9-1 Evaluation Criteria for Transportation, Traffic, and Circulation Impacts 4-55
4.9-2 Existing and Projected Travel Times: Boston and New York City 4-56
4.9-3 Proposed 2010 Boston-New York Amtrak Service on the NEC[1] 4-57
4.9-4 Projected 2010 Amtrak and Commuter Ridership at Express Stations (on & off) 4-61
4.9-5 Express Station Intersection Analysis 4-62
4.9-6 Amtrak-Generated Parking Demand at Railroad Stations[1] 4-64
4.9-7 Commuter Rail Traffic 4-67
4.9-8 Truck Trips in Various Freight Rail Growth and Mode Shift Scenarios, Connecticut and Rhode Island, 2010 4-69
4.9-9 Railroad Movements, Typical Weekday, 2010 4-70
4.9-10 Projected Maritime Delays at Bridges in Excess of 20 Minutes, 4 AM - 12 Midnight, Typical Weekday, 2010 4-72
4.9-11 Total Estimated Boat Capacity, 7 AM to 7 PM, Typical Weekday, 1993 and 2010 4-73
4.9-12 Detour Intersection Analysis 4-81
4.10-1 Air Quality Evaluation Criteria 4-82
4.10-2 1992 and Projected 2010 Emissions by State for VOC, NO_x, CO, and SO_2 4-83
4.10-3 Projected 2010 Emissions by State for VOC, NO_x, CO, and SO_2, No-Build Alternative - AMD-103 Scenario and the Proposed Action 4-83
4.10-4 Comparison of Estimated 2010 Daily Mobile Source VOC Emissions by Mode of Travel 4-84
4.10-5 Comparison of Estimated 2010 Daily Mobile Source NO_x Emissions by Mode of Travel 4-84
4.10-6 Comparison of Estimated 2010 Daily Mobile Source CO Emissions by Mode of Travel 4-85
4.10-7 Comparison of Estimated 2010 Daily Mobile Source SO_2 Emissions by Mode of Travel 4-86
4.10-8 Estimated Maximum 8- and 1-Hour CO Concentrations[1] at the Intersection of University Avenue and Blue Hill Drive, 1992 and 2010 4-88
4.10-9 Estimated Maximum 8- and 1-Hour CO Concentrations[1] at the Intersections of Blue Hill Drive and Route 128 South Ramps, 1992 and 2010 4-89
4.10-10 Comparison of Air Quality in 2010 in Base Case and Alternative Analyses 4-92
4.10-11 Projected 2010 Emissions for VOC, NO_x and CO in Various Freight Rail Growth and Mode Shift Scenarios 4-93
4.11-1 Evaluation Criteria for Visual and Architectural Impacts 4-94
4.12-1 Evaluation Criteria for Impacts to Natural Resources 4-105

CHAPTER 5

5.1-1 Fencing Locations 5-7
5.1-2 Potential Impacts and Mitigation at Facility Sites and Roadway and Railroad Bridges 5-13
5.4-1 Potential State and Federal Permits and Approvals Required for the Proposed Electrification Project 5-23

LIST OF FIGURES

EXECUTIVE SUMMARY

ES 1.1 Connecticut Facility and Bridge Modification Sites ES-3
Rhode Island and Massachusetts Facility and Bridge Modification Sites ES-4

CHAPTER 1

CHAPTER 2

2.2-1 Inland, Airline, and Shore Line Routes 2-8
2.2-2 Freight Density: Shore Line and Inland Routes 2-12
2.4-1 View of Typical Catenary System 2-30
2.4-2 Connecticut Facility and Bridge Modification Sites 2-31
2.4-3 Rhode Island and Massachusetts Facility and Bridge Modification Sites 2-32
2.4-4 Typical Catenary Pole Installation 2-36
2.4-5 Typical Portal Structure 2-37
2.4-6 Clearance Requirements at Overhead Bridges 2-39

CHAPTER 3

3.8-1 At-Grade Crossing Locations 3-21
3.9-1 1993 Connecticut Moveable Bridge Summary 3-28
3.10-1 Locations of Modeled Intersections in the Vicinity of Route 128 Station 3-35
3.11-1 Existing View from Residence at 76 Thimble Island Road in Stony Creek Section of Branford, CT 3-37
3.11-2 Existing View from Residence at 211 Seneca Drive in Noank Section of Groton, CT 3-37
3.11-3 Existing View from Residence at 162 Wilcox Road in Stonington, CT 3-38
3.11-4 Existing View from Residence at 13 Lambert's Lane in Stonington, CT 3-38
3.11-5 Existing View from Harborwatch Condominiums at 4496 Boston Post Road in Warwick, RI 3-39
3.11-6 Existing View Looking Eastbound at Freeman's Crossing, Stonington, CT 3-41
3.11-7 Existing View Looking South at Freeman's Crossing, Stonington, CT 3-41

CHAPTER 4

4.4-1 Projected L_{max} for Trains at 100 Feet 4-21
4.4-2 Projected SEL for Trains at 100 Feet 4-22
4.5-1 Magnetic Field Intensity Above Submarine Cable 4-36
4.9-1 Connecticut Moveable Bridges 4-71
4.9-2 NEC/CA/T Existing Conditions 4-75
4.9-3 NEC/CA/T Future Interface 4-76
4.9-4 Millstone Road West and Kenyon School Road Detours 4-78
4.9-5 Park Avenue and Pettaconsett Avenue Detours 4-79
4.9-6 Maskwonicut Street Detour 4-80
4.11-1 and -2 2010 No-Build Alternative View & View with Proposed Electrification from Residence at 76 Thimble Island Road in Stony Creek Section of Branford, CT. 4-96
4.11-3 and -4 2010 No-Build Alternative View & View with Proposed Electrification from Residence at 211 Seneca Drive Noank Section of Groton, CT. 4-97

LIST OF FIGURES (Continued)

4.11-5 and -6 2010 No-Build Alternative View & View with Proposed Electrification from Residence at 162 Wilcox Road in Stonington, CT. 4-98
4.11-7 and -8 2010 No-Build Alternative View & View Proposed Electrification from Residence at 13 Lambert's Lane in Stonington, CT. 4-99
4.11-9 and -10 2010 No-Build Alternative View & View with Proposed Electrification from Harborwatch Condominiums at 4496 Boston Post Road in Warwick, RI. 4-100
4.11-11(a) and (b) Comparison of the Historic Pole Line and the Future Catenary System Looking Eastbound & View with Proposed Electrification Looking Eastbound at Freeman's Crossing, Stonington, CT 4-102
4.11-12(a) and (b) Comparison of the Historic Pole Line and the Future Catenary System Looking South & View with Proposed Electrification Looking South at Freeman's Crossing, Stonington, CT 4-103

APPENDIX A

A-1 Branford Substation MP 79.26 A-2
A-2 New London Substation MP 123.55 A-3
A-3 Warwick Substation MP 176.91 A-4
A-4 Roxbury Crossing Substation MP 226.02 A-5
A-5 Westbrook Switching Station MP 103.74 A-6
A-6 Richmond Switching Station MP 150.15 A-7
A-7 Norton Switching Station MP 198.99 A-8
A-8 Leetes Island Paralleling Station MP 85.99 A-9
A-9 Madison Paralleling Station MP 92.41 A-10
A-10 Grove Beach Paralleling Station MP 99.11 A-11
A-11 Old Lyme Paralleling Station MP 109.50 A-12
A-12 Millstone Paralleling Station MP 117.54 A-13
A-13 Noank Paralleling Station MP 129.52 A-14
A-14 Stonington Paralleling Station MP 134.65 A-15
A-15 State Line Paralleling Station MP 139.93 A-16
A-16 Bradford Paralleling Station MP 145.19 A-17
A-17 Kingston Paralleling Station MP 157.11 A-18
A-18 Exeter Paralleling Station MP 161.78 A-19
A-19 East Greenwich Paralleling Station MP 169.80 A-20
A-20 Elmwood Paralleling Station MP 181.49 A-21
A-21 Providence Paralleling Station MP 187.45 A-22
A-22 Attleboro Paralleling Station MP 193.40 A-23
A-23 East Foxboro Paralleling Station MP 205.70 A-24
A-24 Canton Paralleling Station MP 212.38 A-25
A-25 Readville Paralleling Station MP 219.08 A-26
A-26 New London Substation Utility Cable Route A-27
A-27 Millstone Road (West) Bridge All MP 117.31 A-28
A-28 Millstone Road (West) Bridge MP 117.31 A-29
A-28(a) Burdickville Road Bridge MP 148.41 A-30
A-28(b) Burdickville Road Bridge MP 148.41 A-31
A-29(a) Kenyon School Road Bridge MP 154.04 A-32
A-29(b) Kenyon School Road Bridge MP 154.04 A-33

LIST OF FIGURES (Continued)

A-30(a) Pettaconsett Avenue Bridge MP 178.46 A-34
A-30(b) Pettaconsett Avenue Bridge MP 178.46 A-35
A-31 Park Avenue Bridge MP 180.29 A-36
A-32(a) Maskwonicut Street Bridge MP 211.62 A-37
A-32(b) Maskwonicut Street Bridge MP 211.62 A-38

EXECUTIVE SUMMARY
AND
DRAFT RECORD OF DECISION

ES.1 INTRODUCTION

This document is the final environmental impact statement and final environmental impact report[1] (FEIS/R) on the proposal by the National Railroad Passenger Corporation (Amtrak) to complete the electrification of the Northeast Corridor main line by extending electric traction from New Haven, CT, to Boston, MA.

Amtrak's proposal is part of the Northeast Corridor Improvement Project (NECIP), a comprehensive program to upgrade rail passenger service between Washington, DC, and Boston. The FEIS/R supplements the Final Programmatic Environmental Impact Statement (PEIS) on NECIP, published by the Federal Railroad Administration (FRA) in 1978.

Based in part on the PEIS, FRA made a decision to undertake a specific program of improvements to the Northeast Corridor (NEC) main line. Included in this program was the extension of electric traction (electrification) between New Haven and Boston. Electrification was addressed in the PEIS at a level of detail commensurate with that document's focus on larger, programmatic issues. FRA determined that a more detailed site-specific environmental analysis would be prepared prior to release of Federal funds to implement this aspect of NECIP.

The detailed environmental analysis of the proposed electrification project began with public scoping meetings in the fall of 1991. A combined draft environmental impact statement and draft environmental impact report (DEIS/R) on this proposed project was published by the FRA in October 1993, and filed with the U.S. Environmental Protection Agency (EPA) and the Massachusetts Executive Office of Environmental Affairs (EOEA). The public was afforded the opportunity to review and comment on the DEIS/R in writing during a period of public review that lasted from October 15, 1993 to January 21, 1994. In addition, FRA held public hearings for the purpose of receiving comments on the DEIS/R on November 16 in Boston, MA (afternoon and evening meetings); on November 17 in Cranston, RI (afternoon and evening); and on November 18 in Old Saybrook, CT (afternoon), and New London, CT (evening). Two EOEA consultation sessions were held on January 12 (evening) and January 13 (afternoon) in the Roxbury neighborhood of Boston.

FRA has carefully considered all of the comments received on the DEIS/R. In some cases design refinements were made by Amtrak, additional analyses were performed, and further explanations of potential impacts incorporated into the FEIS/R as a result of those comments. Based on the analysis contained in this FEIS/R, the PEIS and other relevant considerations, FRA has selected the Proposed Action, as modified by provisions contained in Chapter 5 of the FEIS/R designed to mitigate potential adverse impacts of the Proposed Action, as FRA's preferred alternative.

ES 1.1 DESCRIPTION OF THE PROPOSED ACTION

Presently, Amtrak trains operating over the NEC between Washington, DC, and New Haven, are powered by electricity transmitted to the trains by overhead transmission lines referred to as catenary. New Haven is the northern limit of Amtrak's electrified rail system and NEC trains continuing on to Boston must change there to diesel locomotives.

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[1] Preparation of an environmental impact report is required by the Massachusetts Environmental Policy Act (301 CMR 11.00). Rhode Island and Connecticut environmental review procedures accept environmental impact statements prepared pursuant to the provisions of the National Environmental Policy Act.

Amtrak proposes to complete the electrification of the Northeast Corridor. This proposed project consists of installation of 156 route miles of overhead catenary, development of connections to local utilities at four locations, installation of 25 fixed facilities to transform and regulate the electrical power for railroad use, and modification to seven overhead bridges to provide necessary clearances (see Figure ES 1.1).

Since 1991, Congress has appropriated a total of $292.8 million earmarked for the proposed electrification project which amounts to 75 percent of its expected cost. Amtrak has awarded a contract to a consortium of construction, engineering, and electric traction firms to design and build the proposed electrification improvements. Presently, the design of this system is at the 60 percent completion stage. Amtrak estimates that, with the necessary permits and approvals, construction can begin in the Spring of 1995 and will take approximately 3 years.

ES 1.2 BACKGROUND AND NEED FOR THE PROPOSED ACTION

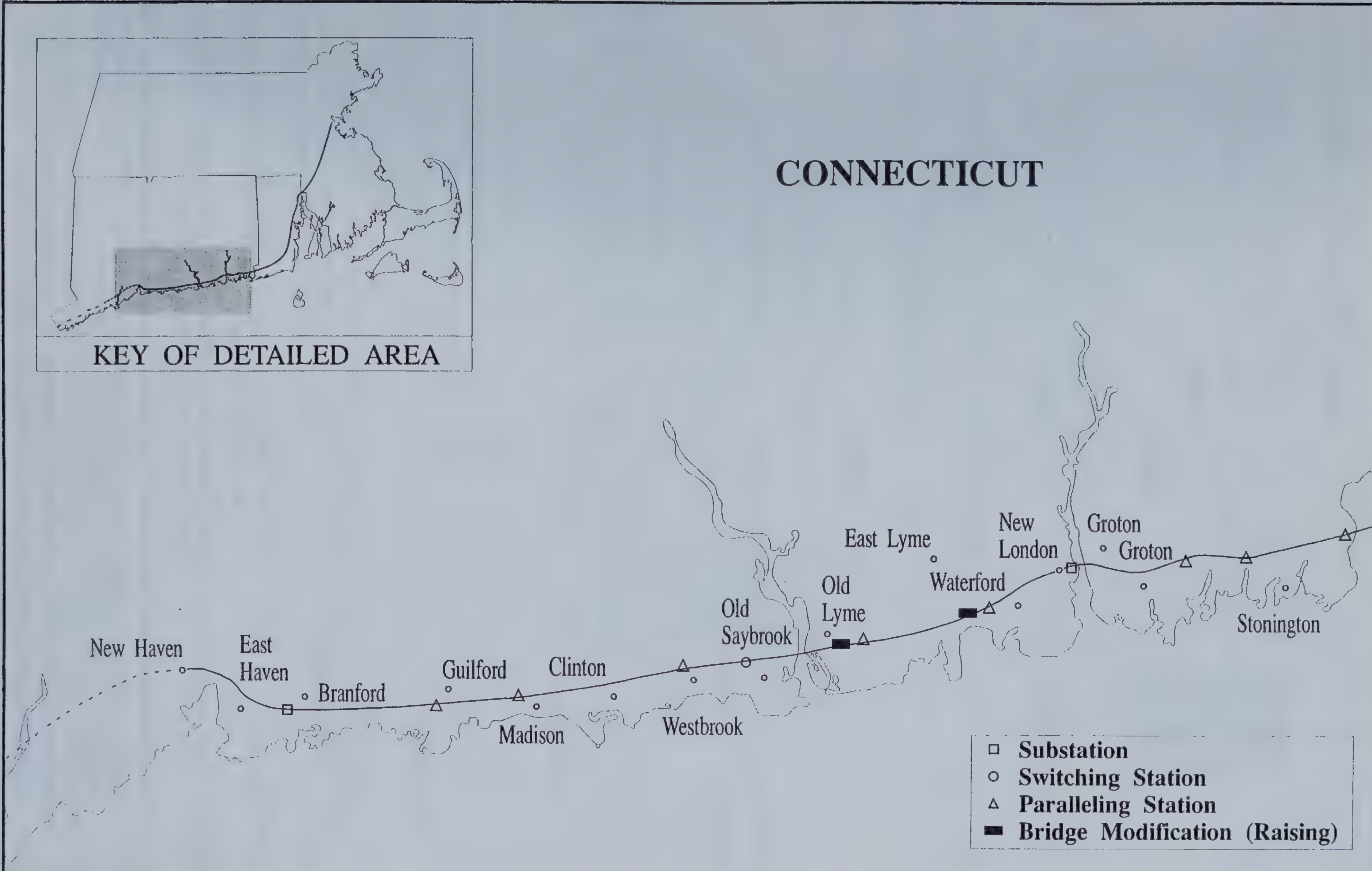
The NECIP is an ongoing comprehensive program with a goal of improving intercity rail passenger service from Washington, DC, through New York City, NY, to Boston, MA. To date, over $3.0 billion has been invested by the Federal Government as part of NECIP in upgrading the rail infrastructure of the NEC resulting in significant improvements to intercity rail service provided by Amtrak and to commuter rail passenger service provided by various public agencies.

The current focus of NECIP is on those remaining improvements between New York City and Boston necessary to reduce intercity express train trip times between those two cities, with intermediate stops, to less than 3 hours. The current express train trip time between Boston and New York City is approximately 4 hours. Amtrak believes that with express intercity trip times of less than 3 hours (the NECIP statutory goal) and substantially improved conventional service, Amtrak will become the preferred intercity common carrier in the Boston to New York City market, much as it is presently the preferred intercity common carrier between New York City and Washington, where *Metroliner* trip times are approximately 2 hours and 50 minutes.

Reduced travel times and increased service reliability would increase the attractiveness of rail travel over alternate means with resulting transportation and environmental benefits. The potential diversion of automobile and air traffic to intercity rail could reduce vehicular traffic on major highways and surface roads, particularly those serving the region's major airports, and slow down the growth of air traffic, easing air traffic congestion. This, in turn, would yield important regional and community air quality, energy efficiency, land use, and noise level benefits. Such improvements would be consistent with important Federal and state environmental objectives, including those specified in the 1990 Federal Clean Air Act Amendments (CAAA) mandating use of transportation technologies to improve air quality.

One of the major uncompleted elements of NECIP that Amtrak has identified as necessary to meet the statutory trip time goal is the extension of electric traction between New Haven and Boston. Electric powered trains have operating characteristics (e.g., maximum speed, acceleration and deceleration rates, reliability, and cost of maintenance) that make them superior to other forms of railroad traction presently in service.

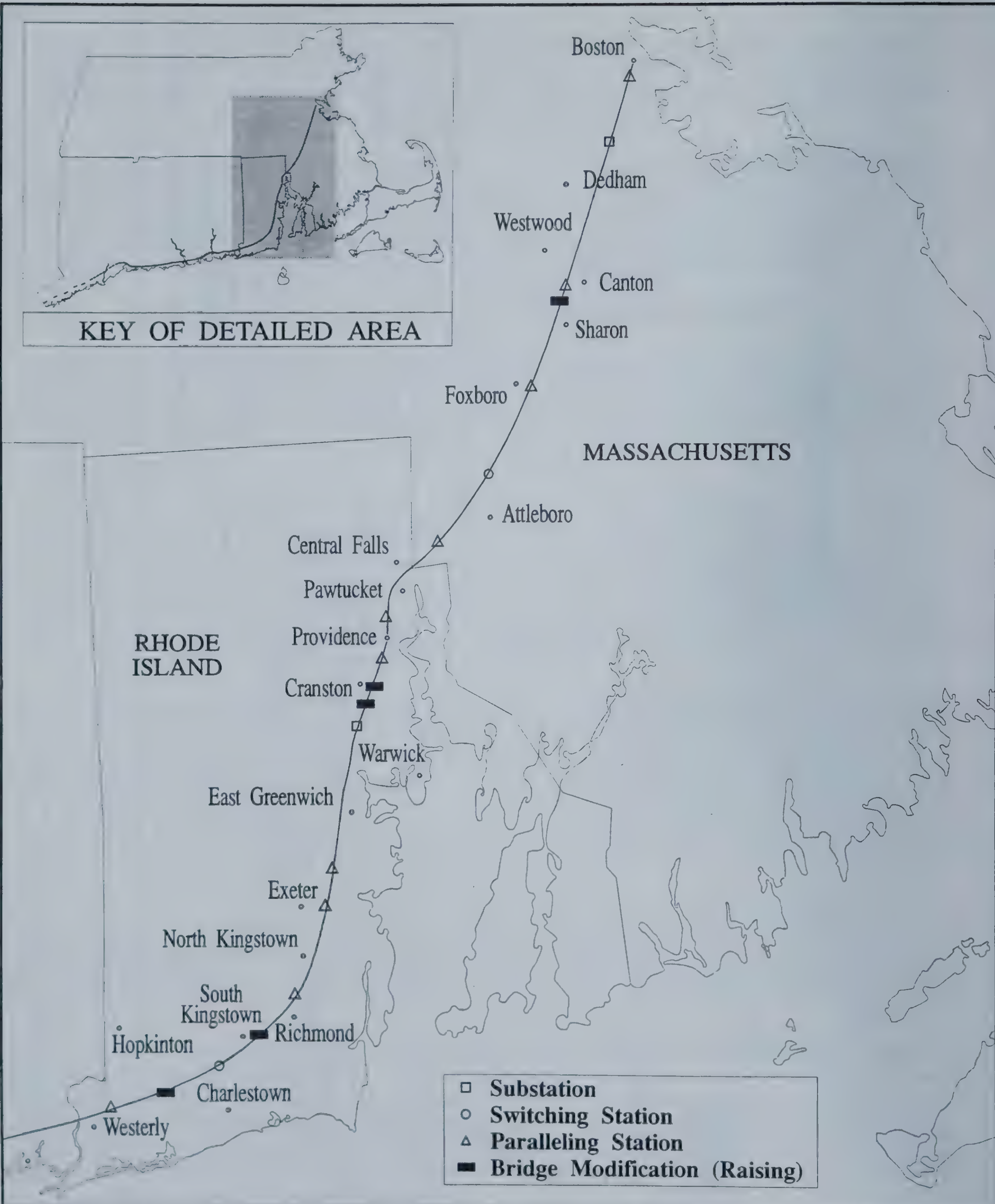
In the context of improved rail passenger service between Boston and New York City, electric traction also addresses site specific operational concerns. The first is the trip time delay associated with switching from non-electric (diesel) locomotives to electric locomotives at New Haven. The second is the severe capacity constraints in the New York City railroad tunnels and at Pennsylvania Station which would be exacerbated by additional non-electric trains. The third is the ability to improve Amtrak equipment utilization by permitting service between Washington and Boston without a change in equipment. In addition, electrically powered railroads offer energy and air quality advantages over available alternatives.



CONNECTICUT FACILITY AND BRIDGE MODIFICATION SITES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure ES 1.1



RHODE ISLAND AND MASSACHUSETTS
FACILITY AND BRIDGE MODIFICATION SITES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure
ES 1.2

ES.2 ALTERNATIVES CONSIDERED

Notwithstanding clear Congressional direction to FRA to upgrade the existing Northeast Corridor main line by extending electric traction between New Haven and Boston, FRA evaluated a wide range of alternatives, first as part of the PEIS and then as part of this EIS/R process. The following summarizes the major alternatives reviewed in the FEIS/R.

Route Alternatives

The PEIS considered two alternative routes between New Haven and Boston as candidates for upgrading as part of NECIP. The NECIP program decision made in 1978 included the selection of the existing NEC main line between New Haven and Boston, referred to as the Shore Line. Since that decision, over $1.1 billion has been invested in upgrading the Shore Line.

Building upon the analysis contained in the PEIS, the scope of this EIS/R has a more narrow focus than the PEIS. Its scope is to evaluate alternatives to the extension of electric traction to the Shore Line. However, route alternatives were reviewed to determine whether any change had occurred since the PEIS was completed that warranted a reassessment of FRA's decision to upgrade the Shore Line.

Three alternative routes between New Haven and Boston were reviewed as part of this EIS/R:

- Inland Route through Hartford, CT, Springfield, MA, and Worcester, MA
- Airline Route through Middletown, CT, Willimantic, CT, Woonsocket, RI, and Walpole, MA
- Shore Line realignment between Old Saybrook, CT, and Westerly, RI

In reviewing these alternatives as part of the FEIS/R, no change in circumstance was identified that established an alternative route as clearly superior from an environmental standpoint to the program decision made by FRA in 1978 to improve the Shore Line. The different alternative routes would lessen or eliminate the impacts associated with upgrading the Shore Line in certain specific areas. This would be offset by the significant impacts associated with construction of these new routes as well as the transference of many of the operational impacts to other areas. In addition, the time required to obtain necessary permits and approvals, and to construct alternative routes, would substantially delay the environmental benefits that will be derived from high-speed rail service between Boston and New York City. Moreover, each of the route alternatives has significantly higher capital costs. At this time, the necessary capital to implement these alternatives is not available and it does not appear likely that it will become available in the foreseeable future. This calls into question the viability of these alternatives.

As a consequence, FRA concluded that further consideration of route alternatives was unnecessary. The detailed analysis of alternatives carried forward into the FEIS/R addressed alternative approaches to providing improved intercity passenger service over the Shore Line.

Alternatives Carried Forward Into the FEIS/R

The FEIS/R analyzes the following two basic alternatives, Amtrak's Proposed Action and the No-Build Alternative.

Amtrak's Proposed Action: Amtrak's proposed electrification project is composed of a number of elements that may impact environmental resources. These include:

- An overhead catenary system (OCS) composed of wires suspended over the railroad tracks and generally supported by pairs of steel poles, approximately 31 feet high, placed on either side of the railroad tracks. The poles would support a cantilevered arm from which the wires are suspended. Each set of poles would be

spaced approximately 200 feet from the next pair on tangent track and closer along curved track sections. In areas spanned by more than two tracks, portal structures with a solid beam between the two poles or double cantilevered poles would be used.

- Substations and utility supplies to provide electricity from the local utility company to the substation via a tie-in from the utility's transmission network. The utility lines consist of either overhead or underground wires from local transmission lines to the new substation. The substation "steps down" or converts the 115,000 volts (115 kV) on the utility's power line to the 25 Kv levels via a transformer at the substation. The 25 Kv feed is then connected to the OCS for use by the locomotive. Each of the four substations on the NEC would consist of a fenced area of approximately 0.5 acre.

- Switching stations and paralleling stations (intermediate power supply points for the OCS) are smaller in scale than substations and contain transformers that connect the feeder to the catenary. By employing these smaller facilities, fewer substations and utility tie-ins are needed, since power can be carried farther down the rail line than if no feeder and intermediate supply points are used. Eighteen paralleling stations of approximately 0.10 acre and three switching stations of approximately 0.15 acre would be constructed along the NEC.

- Clearance improvements at 40 locations where overhead structures, such as roadway and pedestrian bridges, currently restrict vertical clearance over the tracks. One of two actions would be taken at these structures to provide necessary clearances for the catenary and maintain existing rail traffic. These measures are: (1) the railroad tracks would be lowered using a technique known as undercutting (33 locations); or (2) the bridge would be raised (seven locations).

No-Build Alternative: Under this alternative, the proposed electrification project would not proceed. In the absence of the proposed electrification project, it is unclear what actions, if any, would be taken to improve rail passenger service in the Boston to New York City portion of the NEC. The No-Build Alternative, therefore, addresses three different scenarios of what might happen in the absence of electrification. These scenarios are:

- **No-Build Alternative - AMD-103:** Under this scenario, Amtrak would maintain its existing level of service between Boston and New York City with its top-of-the-line diesel locomotive, the AMD-103, and no further NECIP improvements would be undertaken to enhance the speed of intercity passenger operations. This scenario is the basic No-Build Alternative contained in the DEIS/R.

- **No-Build Alternative - FF-125:** It is also possible that if a decision is made not to proceed with electrification, Congress would provide funding for new non-electric trainsets. Amtrak's ongoing high-speed equipment purchase program includes two trainsets (of 26 total) that would be powered by fossil fuel locomotives capable of top speeds of 125 mph (hence FF-125). Under this scenario, the northern end of the NEC would not be electrified, and the two fossil fuel trainsets would become the lead units of a fossil fuel fleet providing service between Boston and New York City. All other planned NECIP improvements would also be undertaken.

- **No-Build Alternative - FRA-150:** It is also possible that if a decision is made not to proceed with electrification, Congress would provide funding for new, more advanced non-electric trainsets rather than acquiring the locomotives to be provided as part of Amtrak's 1994 equipment order.

As part of the Clinton Administration's High-Speed Rail Initiative, the Department of Transportation submitted a legislative proposal that would establish and fund a new high-speed rail technology development program. A major part of this program is FRA's proposal to facilitate development of a high-speed non-electric locomotive/trainset with a top speed of 150 mph+, an acceleration capability equivalent to the best electric locomotives/trainsets, and which addresses the cost, reliability, and environmental issues associated with past high-speed non-electric locomotives. Under this scenario, it is assumed that this program is authorized, funded and proves successful in achieving its goal and that this equipment is acquired for use between Boston and New York City. In addition, all other NECIP improvements would be undertaken.

Inclusion of the FF-125 and FRA-150 scenarios in the FEIS/R is, in part, in response to several comments on the DEIS/R which suggested that there should be additional discussion on the ability of existing and planned non-electric high-speed technologies to serve as alternatives to electric traction.

Rail Service Under the Alternatives

Proposed Action: The Proposed Action together with the other improvements planned as part of NECIP will generate greater demand for intercity rail passenger service. To meet this demand, Amtrak plans to operate 16 express and 10 conventional round trips per day between Boston and New York City (with most trains continuing on to Washington, DC). The FEIS/R assumes that such levels of rail operations in fact do occur with this full level of operation being achieved in 2010. In the study area, express service would make stops at New Haven, CT; Providence, RI; Route 128 Station in Dedham, MA; and Back Bay Station in Boston, MA, before terminating at South Station in Boston, MA. At least three express trains would also stop at New London, CT. Conventional service would continue to those communities presently served by Amtrak's non-express trains. In addition to those stations served by express service north of New Haven, conventional train service would be provided at Old Saybrook, New London, and Mystic, CT, and Westerly and Kingston, RI, although not all such trains would make all of these stops.

No-Build Alternative - AMD-103 Scenario: Under this scenario, there would be a modest growth in intercity passenger demand. To meet that demand, Amtrak is assumed to operate two express and 10 conventional round trips per day.

No-Build Alternative - FF-125 and FRA-150 scenarios: Under these scenarios, it is assumed that Amtrak would provide the same level of service as planned for the Proposed Action except that the trains would be turned at New York City for a return trip to Boston instead of continuing on to Washington.

ES.3 COMPARATIVE BENEFICIAL AND ADVERSE IMPACTS OF ALTERNATIVES

The No-Build Alternative - AMD-103 scenario is viewed as the 2010 baseline against which the Proposed Action and the other No-Build Alternative scenarios are evaluated. The following discussion focuses on the most significant impacts, both beneficial and adverse, of the Proposed Action and No-Build Alternative scenarios.

ES 3.1 TRANSPORTATION

Under the Proposed Action, Amtrak would provide express trip times between Boston and New York City of less than three hours and conventional trip times of 3:45. The No-Build Alternative - AMD-103 scenario would maintain existing schedules of 4 hours for express trains and 5 hours for conventional trains. The No-Build Alternative - FF-125 alternative's trip times were assumed to be approximately 20 to 25 minutes slower than the Proposed Action trip times. The No-Build Alternative - FRA-150 scenario was assumed to have trip times approximately equal to the Proposed Action.

<u>Ridership:</u> The expected ridership to be attracted to intercity rail passenger service in 2010 was projected for the Proposed Action and the No-Build Alternative scenarios and is discussed in Section 4.9. These projections are presented below:

Boston to New York City Intercity Rail Ridership (2010)
(million trips per year)

	Proposed Action	No-Build Alternative		
		AMD-103	**FF-125**	**FRA-150**
Passengers	3.63	1.87	2.84	3.46

As can be seen, the Proposed Action is projected to generate the highest intercity rail passenger ridership.

Diversion from other modes: The projections of growth in intercity rail ridership over the AMD-103 scenario reflect a diversion of intercity passengers from existing intercity forms of transportation, primarily air and highway. This in turn lessens the congestion experienced by these two modes, or alternatively, provides capacity in these modes for additional growth. The table below compares the allocation of ridership in 2010 among the principle intercity modes of transportation for the alternative scenarios discussed above.

Boston to New York City Total Intercity Trips - All Modes (2010)
(million trips per year)

	Proposed Action	No-Build Alternative		
		AMD-103	**FF-125**	**FRA-150**
Intercity Rail	3.63	1.87	2.84	3.46
Air	2.35	3.78	2.99	2.48
Auto	15.60	15.92	15.74	15.63

Impacts on freight rail transportation: In the absence of measures to provide additional capacity, the Proposed Action could have the potential to impact the use of the NEC main line by commuter and freight operators during construction and after the project is completed due to the differential speed between high-speed intercity trains and freight trains. These potential impacts (see Sections 4.2 and 4.9) are addressed in the mitigation measures required as part of this FEIS/R in Chapter 5.

Concern has also been expressed that increased use of the NEC main line by passenger trains could adversely affect the ability of freight railroads to provide service with resulting adverse impacts on the local economy. Such impacts do not result from the Proposed Action per se, but rather from the general increase in intercity traffic that will result from the NECIP program as a whole, from state initiatives to improve commuter rail service on the NEC, and from growth to freight service anticipated by the freight railroads. As such, the potential for impact in this area under the No-Build Alternative - FF-125 and FRA-150 scenarios is essentially the same as with the Proposed Action.

An analysis of the potential impact of possible NEC capacity constraints on freight service was undertaken. This analysis showed that if capacity and other constraints on use of the NEC main line were to so affect the freight service as to drive up freight costs by as much as 5 percent, a substantial portion of freight that otherwise would move by rail could be diverted to truck, thus consuming more fuel, generating more air pollution, and having an adverse impact on employment, and therefore the economy of the region.

Measures contained in Chapter 5, which include improvement or restoration of nine side tracks, will provide sufficient capacity in the NEC main line so that the Proposed Action will not result in any significant impact on existing freight rail use of the NEC main line. Additional measures incorporated in the Northeast Corridor Transportation Plan (NECTP), released by FRA in July 1994, would accommodate all users' projected needs through 2010.

The State of Rhode Island seeks to develop a new port at Quonset Point, RI. As part of these efforts, the state is evaluating alternative approaches to provide enhanced rail access to this port facility which might involve construction of a third track parallel to the NEC main line in Rhode Island. The Rhode Island Department of Transportation, together with the Federal Highway Administration (FHWA) and FRA, has initiated preparation of on EIS on this effort. Chapter 5 identifies those measures that will be incorporated into the electrification project to accommodate whichever alternative the state decides to implement.

Impacts on commuter rail operations: The Proposed Action is projected to have little impact on the current operations of commuter railroads using the NEC main line. Conversion to electric traction is a long-term goal of the Massachusetts Bay Transportation Authority and the facilities planned as part of the Proposed Action have been designed to accommodate future MBTA electrification. The Proposed Action will help facilitate this conversion with its resulting energy, air quality and noise benefits. Mitigation contained in Chapter 5 will address potential impacts on commuter service during construction and as a result of the increased speed and frequency of Amtrak's proposed service.

The states along the Northeast Corridor expect to significantly expand commuter rail service on the NEC main line. Such growth in traffic creates concerns over the capacity of the NEC to meet all of its needs. As with freight traffic discussed above, this is not an issue solely associated with the Proposed Action and it would be of concern under the No-Build Alternative - FF-125 and FRA-150 scenarios as well. These capacity needs have also been incorporated into the NECTP.

There is one intercity/commuter capacity issue that has implications for the No-Build Alternative - FF-125 scenario. Access to New York City's Pennsylvania Station is via a series of constricted tunnels in which non-electric locomotives must convert to electric power. Presently, this is accomplished through use of the 600 volt DC third rail system. The performance of non-electric trains using that system is significantly worse than electric trains using the overhead catenary. As a consequence, in assigning "slots" for use by trains during peak hours, a non-electric train using third rail uses two slots for each movement compared to one slot used by Amtrak's current AEM-7 electric locomotives or the new electric equipment being acquired for NEC service.
There is significant demand for the limited available capacity in the New York City railroad tunnels and this demand is increasing significantly. The inferior performance of the FF-125 scenario under these conditions may restrict the number of intercity trains that could operate between Boston and New York City during peak hours below the number planned by Amtrak. FRA's high-speed non-electric locomotive program intends to address issues concerning dual mode power. As a consequence, it is assumed that under the No-Build Alternative - FRA-150 scenario, the improved non-electric locomotive would have performance equivalent to the electric train operation.

Capacity constraints in this area under the No-Build Alternative FF-125 and FRA-150 scenarios would also be exacerbated by the need to turn the equipment (with the associated servicing requirements) at Pennsylvania Station for its return trip to Boston. The Proposed Action will permit trains to operate between Boston and Washington without a change in equipment or transfer of passengers, thereby minimizing the occupancy of Pennsylvania Station platforms.

Impacts on marine traffic through moveable bridges: Another issue raised in the context of this project is the effect of increased rail operations on marine traffic passing through the five moveable bridges between Old Saybrook and Stonington, Connecticut. Concern has been expressed that more frequent rail operations would reduce the time available for boats to transit through the bridges, thereby restricting marine traffic and having adverse effects on the local economy.

As with the potential impacts on freight rail service discussed above, impacts on marine traffic do not result from the Proposed Action per se, but rather from the general increase in intercity traffic that will result from the NECIP program as a whole, from state initiatives to improve commuter rail service on the NEC, and from growth to freight service anticipated by the Providence and Worcester Railroad. As such, the potential for impact in this area under the No-Build Alternative - FF-125 and FRA-150 scenarios is essentially the same as with the Proposed Action.

Despite the additional time that bridges are required to be closed for train passages, there are sufficient periods of time in most hours to permit opening of the bridges for marine access. Additionally, a number of projects have been included in the NECIP, such as improved signalling and new equipment, which will make rail service more reliable, and the proposed replacement of the bridges at Niantic and Groton which will make bridge operation more reliable. These actions will tend to mitigate some of the adverse impact in this area.

The Coast Guard has indicated that necessary marine access should be possible with the development of a bridge operating plan that addresses train schedules, bridge maintenance, signals and train controls, better information to mariners, and other related issues. Amtrak will work with the Coast Guard and other interested parties to develop this plan, and will not significantly increase the frequency of rail operations until an acceptable plan is developed. Such a plan would mitigate a substantial portion of the adverse impacts of NECIP in this area.

In a related issue, during preparation of the NECTP, FRA learned that there was substantial local concern that highway access to those marinas which presently must use highway-rail grade crossings could be impacted by proposals to close grade crossings. The analysis of rail operations across these grade crossings show that there would be little, if any, impact on the highway access to these marinas by the Proposed Action and no grade crossing eliminations are proposed as part of this project.

ES 3.2 ENERGY CONSUMPTION

The energy consumption of the alternatives in 2010 was estimated. The following table compares the total energy in BTUs used for intercity transportation in the study corridor under the Proposed Action and No-Build Alternative scenarios:

Total Energy Consumption - All Modes
(billion Btu per year)

	Proposed Action	No-Build Alternative		
		AMD-103	FF-125	FRA-150[2]
Intercity Rail[3]	1,824	419	2,924	NA
Auto	8,260	10,809	10,686	NA
Air	3,079	5,822	4,786	NA
Total	13,163	17,050	18,396	NA

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[2] Since FRA's proposed locomotive development program is in its early stages, the energy consumption of this scenario cannot be estimated at this time. Improved fuel efficiency will be a major goal of this program. Several potential participants in the program believe there are opportunities for significant improvements in the fuel efficiency of non-electric locomotives.

[3] The energy consumption estimate for intercity rail in Section 4.6 uses two sets of assumptions. This table uses the more conservative set. Under assumptions that more closely reflect what is likely to occur, intercity rail energy consumption would be approximately 60% of the levels used in this table. Consumption based on these latter tables is presented in the following table.

As can be seen, high-speed rail service has significant advantages over existing intercity transportation in the area of energy use, with the Proposed Action being the most energy efficient of the scenarios. A more direct comparison between the rail alternatives is made in the table below which compares the BTU consumption of the rail alternatives on a seat-mile and passenger-mile basis.

Intercity Rail Energy Consumption[4]

	Proposed Action	No-Build Alternative		
		AMD-103	FF-125	FRA-150
BTU/seat-mile	885	844	1,634	NA
BTU/passenger-mile	1,675	1,417	3,324	NA

ES 3.3 AIR QUALITY

The regional air quality analysis found that the Proposed Action would result in significant reductions in annual mobile source-related emissions of the three compounds used by Federal and state authorities to determine air quality and public health standards and which are regulated in the State Implementation Plans (SIP) prepared pursuant to the Clean Air Act. These are volatile organic compounds (VOC), oxides of nitrogen (NO_x) and Carbon Monoxide (CO). When compared to the 2010 base line, the Proposed Action results in 5 percent less emission of VOC, 12 percent less emission of NO_x, and 4 percent less emission of CO. The Proposed Action results in an increase in emission of sulfur dioxide (SO_2), however there are no regulatory requirements in the SIPs to reduce SO_2 emissions. As a consequence, the Proposed Action is consistent with the SIPs of all three states in the study xarea.

The following tables summarize the levels of various pollutants projected to be produced by intercity travel. As can be seen in this table, the energy efficiency advantages of the Proposed Action translates into air quality improvements in those areas regulated in the SIPs. The Proposed Action's pollutant emissions would also occur at a limited number of fixed locations (power plants) and would tend to decline as new source controls are incorporated in these power plants.

Total 2010 Mobile Source-Related VOC Emissions (kg per day)

	Proposed Action	No-Build Alternative		
		AMD-103	FF-125	FRA-150
Intercity Rail[5]	7	68	129	NA
Other Rail	154	154	154	NA
Air	256	328	262	NA
Highway	3,370	3,439	3,404	NA
Total	3,787	3,989	3,949	NA

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[4] Consumption figures are based on train consists likely to operate in the NEC. See Note 3.

[5] Includes emissions from electric power generation under the Proposed Action in this and the following two tables.

Total 2010 Mobile Source-Related NO_x Emissions
(kg per day)

	Proposed Action	No-Build Alternative		
		AMD-103	**FF-125**	**FRA-150**
Intercity Rail	1,105	2,221	1,276	NA
Other Rail	5,041	5,041	5,041	NA
Air	1,310	1,925	1,427	NA
Highway	6,240	6,364	6,301	NA
Total	13,696	15,551	14,045	NA

Total 2010 Mobile Source-Related CO Emissions
(kg per day)

	Proposed Action	No-Build Alternative		
		AMD-103	**FF-125**	**FRA-150**
Intercity Rail	81	196	423	NA
Other Rail	442	442	442	NA
Air	1,180	1,665	1,248	NA
Highway	19,929	20,337	20,127	NA
Total	21,632	22,640	22,240	NA

Total 2010 Mobile Source-Related SO_x Emissions
(kg per day)

	Proposed Action	No-Build Alternative		
		AMD-103	**FF-125**	**FRA-150**
Intercity Rail	1,184	305	1,855	NA
Other Rail	693	693	693	NA
Air	52	76	56	NA
Highway	323	329	326	NA
Total	2,252	1,403	2,930	NA

ES 3.4(a) Noise

There are two potential sources of long-term noise emissions from the Proposed Action, noise emanating from the fixed electrical facilities such as transformer hum, and noise from train operations.

The noise from the fixed electrical facilities has the potential to affect up to 75 residences. Measures included in Chapter 5 would reduce these noise emissions to acceptable levels.

With regard to noise from train operations, electric trains would be quieter than the non-electric trains they replace except at extremely high speeds. The exact level of noise emissions from the Proposed Action, however, is unknown at this time because Amtrak has not yet selected the exact equipment to be used in future NEC service. Measurements conducted for FRA of modern European trainsets show significant improvements over the 20+ year old design of current Amtrak electric trains.

Noise emissions are also a function of train frequency, with noise levels growing as train frequency increases. The analysis in Section 4.4 uses three values to identify a range of noise emissions that could occur with the Proposed Action to address this uncertainty. There is a "best" case at 2010 which reflects the level of noise emissions achievable in modern design and the frequency of service projected for 2010. There is a "worst" case that reflects noise emissions from existing Amtrak electric equipment at the frequency of service projected for 2010. However, since FRA is requiring Amtrak to use the results of FRA's studies of modern high-speed equipment in evaluating the equipment that will be acquired for Northeast Corridor service over the next few years, it is expected that the actual noise impact will approach the "best" case. There is also an "initial build" which represents the noise levels that would result from the initiation of electrified operations at existing levels of service assuming "best" case noise emissions from Amtrak's new equipment.

The No-Build Alternative AMD-103 scenario is based upon actual measurements. The FF-125 scenario is based on measurements of the RTL gas turbine trainset currently in operation in New York's Empire Corridor.

The table below compares the number of sensitive residential receptors exceeding the impact threshold for the Proposed Action and the No-Build Alternative - AMD-103 and FF-125 scenarios at the higher levels of service planned for 2010 as well as the level of impact of electrified operations at current levels of service.

Sensitive Residential Receptors Where Noise Exceeds Impact Threshold

	Proposed Action			**No-Build Alternative**		
	Initial	**Best**	**Worst**	**AMD-103**	**FF-125**	**FRA-150[6]**
Sensitive Receptors	14	826	2,243	67	1,486	NA

ES 3.4(b) Vibration

The vibration impacts of improved rail operations closely track noise impacts. Therefore, impacts in this area also exist with the No-Build Alternative - FF-125 and FRA-150 scenarios. The exact level of vibration emissions from the Proposed Action is unknown at this time. Measurements conducted for FRA of modern European trainset show significant improvements over the 20+ year old design of current Amtrak electric trains. As with noise, the analysis in Section 4.4 uses a range of emissions for the Proposed Action to reflect the "best" and "worst" cases. However, FRA is requiring Amtrak to use the results of FRA's studies of modern high-speed equipment in evaluating the equipment that will be acquired for Northeast Corridor service over the next few years, and it is expected that the actual vibration impact will approach the "best" case.

The table below compares the number of sensitive residential receptors exceeding the impact threshold for the Proposed Action and the No-Build Alternative - AMD-103 and FF-125 scenarios.

[6] Reduction of noise and vibration emissions are part of FRA's proposed high-speed non-electric locomotive development program, which has the goal of reducing such emissions to the level of the best electric equipment.

Sensitive Residential Receptors Where Vibration Exceeds Impact Threshold

	Proposed Action			No-Build Alternative		
	Initial	Best	Worst	AMD-103	FF-125	FRA-150
Sensitive Receptors	1,255	1,390	4,269	369	746	NA

ES 3.5 ELECTROMAGNETIC FIELDS

The Proposed Action would generate electromagnetic fields along the rail line and near fixed electrical facilities such as substations. This area of concern is limited to the Proposed Action since the No-Build Alternative scenarios do not require construction of new electrical facilities.

Based on the number of comments received on the DEIS/R, there is substantial concern over the potential health effects of EMF exposure. This is an area where there is no clear scientific consensus. In developing the analysis included in Section 4.5 of the DEIS/R and FEIS/R as well as additional studies conducted for FRA, an extensive review of recent literature on this issue was performed. Some studies have concluded that there may be a causal relationship between certain types of EMF and certain adverse health effects, while other studies have concluded that no such relationship exists.

As a consequence of the lack of scientific consensus, there are no Federal regulations nor clearly defined indicators of EMF impact. Two states have issued guidelines for maximum EMF field intensities associated with transmission lines, and a number of national and international groups or agencies have adopted interim exposure guidelines. These are used in the FEIS/R as bases for estimating impact.

With regard to this specific project, the overhead catenary system and power transfer facilities design has been shown to minimize environmental EMF along the right-of-way in over a decade of operation of a similar system used by the *TGV* electric high-speed rail service in France. The out of phase currents in the catenary and return feeder provide a partial magnetic field cancellation (except for the passengers in the current loop). At 30 feet from the track, the EMF due to this design is about half that produced by each overhead wire's current. In addition to EMF field reduction, this design also minimizes electromagnetic interference (EMI) at the source. The design also minimizes the number of substations and utility tie-ins required for the project, thus limiting the number of potential EMF generators.

The analysis performed for this FEIS/R estimated the likely EMF levels and resulting levels of exposure that would be experienced by various population groups potentially affected by the Proposed Action. For the residential and commercial areas surrounding the right-of-way, the estimated levels of exposure are one one-hundredth (0.01) to one one-thousandth (0.001) of the most relevant exposure guideline. The population segment with the greatest exposure would be passengers and employees on the trains. Their maximum level of exposure would be four one-hundredths (0.04) of the most relevant exposure guideline.

ES 3.6 SAFETY

High-speed rail systems have demonstrated an exceptional degree of safety in their applications overseas. As examples, the Japanese *Shinkansen* has not had a passenger fatality in over 30 years of operation and the French *TGV* has not had a passenger fatality in over ten years of operation. As the agency responsible for all forms of railroad safety, FRA is working closely with Amtrak to ensure that the design of improvements to the Northeast Corridor and the equipment to be operated in high-speed service include those considerations necessary to achieve a similar standard of safety.

There are three primary areas where high-speed operation between New Haven and Boston raises safety concerns regarding the system's surroundings. Those are highway-rail at-grade crossings, commuters waiting on train platforms adjacent to high-speed operations, and trespassers on railroad property. The potential to impact these areas of concern comes primarily from the increased frequency and speed of trains. Since the speed and frequency of the Proposed Action and No-Build Alternative - FF-125 and FRA-150 scenarios are similar, so too would be their impacts in these areas of concern.

In analyzing this issue, FRA found that there would be comparatively small increases in the potential for accidents at highway-rail grade crossings. Pursuant to a Congressional directive, FRA prepared a plan for the elimination of some of the remaining grade crossings of the NEC (see Section 4.8). However, the states are responsible for decisions on whether and when to implement this plan or undertake other actions to improve the safety at highway-rail at-grade crossings. Measures to mitigate the potential impacts at commuter rail stations and to trespassers are incorporated in Chapter 5.

ES 3.7 HISTORIC AND ARCHAEOLOGICAL RESOURCES

A number of historic resources listed on or eligible for inclusion on the National Register of Historic Places were identified on or adjacent to the rail line. The Proposed Action was found to have a potential adverse effect on 31 of these sites. No archaeological resources are expected to be adversely affected by the Proposed Action, with the single exception related to the routing of the New London substation utility feed. Because the No-Build Alternative scenarios would not require construction of any new facilities, they would have no effect on these resources.

FRA has coordinated its review of the potential effect of the Proposed Action on these historic resources with the three State Historic Preservation Officers (SHPO) and the Advisory Council on Historic Preservation. MBased on these consultations, FRA, the SHPOs, and the Advisory Council have entered into memorandums of agreement pursuant to Section 106 of the National Historic Preservation Act to ensure that the Proposed Action incorporates measures necessary to minimize adverse effects on these resources.

ES 3.8 LAND USE

The Proposed Action involves improvements to an existing rail corridor. As a consequence, it is consistent with existing land use for the most part. There are, however, a few exceptions that will be mitigated as part of project design. Since the No-Build Alternative scenarios do not involve any property acquisition, they would be consistent in all respects existing land use.

Relocations: Acquisition of property for the Warwick, RI, substation would require relocation of one business, and acquisition of property for the Norton, RI, switching station would require relocation of one residence. Owners of these properties would be compensated consistent with the Uniform Relocation Assistance and Real Property Acquisition Regulations of the Department of Transportation.

Section 4(f): The NEC main line bisects the 3,350 acre Great Swamp Wildlife Management Area (GSWMA), a wildlife management area near South Kingstown, RI. Any use of the GSWMA by this project must be consistent with Section 4(f) of the Department of Transportation Act. A paralleling station must be located in this area due to voltage drops in the catenary system. This paralleling station would require acquisition of approximately 0.1 acres of the GSWMA immediately adjacent to the NEC main line's right-of-way.

Pursuant to the provisions of Section 4(f), FRA, in consultation with the Rhode Island Department of Environmental Management (RIDEM) and the Department of the Interior, has concluded that there is no feasible or prudent alternative to the use of this property and that the project design will incorporate all reasonable measures to minimize harm. The design of the facility, including fencing and vegetative screening will be coordinated with the RIDEM. In addition, Amtrak will contribute to RIDEM's fund to expand the GSWMA as compensation for this property. A Section 4(f) statement is included in this FEIS/R as Appendix G.

Roxbury Crossing Substation: Substantial concern was expressed in comments on the DEIS/R over the location of the northernmost substation at a vacant parcel of land in the Roxbury neighborhood of Boston. As a result, FRA undertook an extensive review of possible alternative sites. The Roxbury Crossing site remains the technically superior site. However, at least one alternative has been identified that may be technically feasible and that could possibly avoid some of the concerns raised by the Roxbury Crossing site.

FRA believes that the best way to determine the location of the northernmost substation site is through an open process of review and evaluation of the alternative sites involving Amtrak, the local communities, the appropriate agencies of the City and State including the Executive Office of Environmental Affairs and the Massachusetts Bay Transportation Authority. As a consequence, although the FEIS/R discusses the impacts of locating the substation at Roxbury Crossing, FRA is deferring its decision on the location of the northernmost substation. FRA will work with the various interested parties identified above over the next several months to resolve the siting and design of this substation. At the conclusion of that process, appropriate supplements to this FEIS/R will be prepared.

ES 3.9 SOCIOECONOMICS

The Proposed Action would have impacts, both beneficial and adverse, on socioeconomic areas of concern.

Employment: The Proposed Action would create 600 to 700 jobs during the three year construction period. Together with the other NECIP improvements that collectively result in the improved intercity service, between 270 and 280 permanent positions would be created above what would occur with the No-Build Alternative - AMD-103 scenario. In addition, 51 train and engine crew positions will be transferred from New Haven to either New York City or Boston reflecting the elimination of the present switch from electric to diesel power at New Haven. To some extent these job losses will be offset by an expansion of other Amtrak positions at New Haven with the net loss being approximately 28. The changes in permanent employment would be similar under the No-Build Alternative - FF-125 and FRA-150 scenarios.

Property Values and Tax Revenue: It is possible that external effects of the Proposed Action could have a localized impact on the values of properties (and hence property tax revenues generated by such properties) immediately adjacent to the rail line. Due to the multitude of factors that influence property values, quantification of such impacts is not possible. The rail line has been a major part of the communities through which it passes for over a century. To the extent that properties would have lower values based on their close proximity to a heavily used rail line, the effect of such proximity is, to a large extent, reflected in existing property values. Increased noise and vibration and negative public perception about EMF may have some additional adverse effect on some properties. On the other hand, areas in the vicinity of train stations will experience increased accessibility from improved rail service making such locations more desirable for certain kinds of businesses and commuters. To some extent this would offset possible declines in values elsewhere. As a consequence the net impact on property values and tax revenues should be minimal.

The changes in property values would be similar under the No-Build Alternative - FF-125 and FRA-150 scenarios. The largest external effects of improved rail service are in the areas of noise and vibration and accessibility. These alternative scenarios have similar levels of noise and vibration impacts. The FRA-150 scenario would offer nearly the same accessibility as the Proposed Action, while the improvements to accessibility by the FF-125 scenario would be somewhat less. To the extent that concern over EMF influences property values, the No-Build Alternative scenarios would have an advantage over the Proposed Action. However, based on discussions with city assessors' offices, it appears that the effect of EMF on total property value should be small.

Tourism: Some concern has been expressed over the potential of the catenary system to adversely impact scenic vistas and, hence, the attraction to tourists of the coastal communities in Connecticut and Rhode Island. Installation of the catenary will occur close to the time when the existing rail signal pole line that has been part of these scenic views for several decades is removed. The catenary system is not significantly different in scale to the signal pole line, and therefore the impact on the relative attraction of the coastal communities to tourists should be minimal. Under the No-Build Alternative scenarios, the pole line would be removed with no installation

of catenary, thereby removing an element from existing scenic vistas. However, based on comments received, it does not appear that tourism has been adversely affected by the existing pole line. The impact on tourism of its removal should also be minimal.

On the other hand, the Proposed Action and the No-Build Alternative -FF-125 and FRA-150 scenarios, together with the other NECIP improvements, would provide significantly better intercity rail service to the coastal communities, significantly increasing their accessibility to major population centers such as New York City and Boston. Improved accessibility should have a positive impact on tourism.

Freight Rail Service: Concern has been expressed that the Proposed Action would adversely affect the ability of freight railroads to provide service to customers and have a resulting adverse impact on the local economies. As discussed under Transportation above, the impacts of the Proposed Action in this area would be mitigated by the measures included as part of the Proposed Action and identified in Chapter 5. As a consequence, adverse impacts on the local economy relating to freight disruptions should be minimal.

Marine-based Economy: Another concern that has been expressed is that increased use of the five moveable bridges between Old Saybrook and Stonington would limit the time available for marine transit through these waterways, thereby affecting the parts of the economy dependent upon marine uses, most notably recreational boaters. To the extent that there is an adverse impact, it would be highly localized with recreational boaters changing marinas but likely staying in the same general area.

Such impacts would be similar under the Proposed Action and the No-Build Alternative - FF-125 and FRA-150 scenarios. As discussed under Transportation above, the Coast Guard has indicated that necessary marine access could be maintained with the development of a bridge operating plan that addresses train schedules, bridge maintenance, signals and train controls, better information to mariners, and other related issues. Such a plan would mitigate a substantial portion of any adverse impacts of NECIP in this area and is required as one of the mitigating measures identified in Chapter 5.

Minority and Low Income Populations: There are 25 facilities that would be developed as part of the Proposed Action. One may be located in a minority neighborhood (the Roxbury Crossing substation) and one would be in a low income non-minority neighborhood. As a consequence, the Proposed Action does not disproportionately affect minority or low income populations.

ES 3.10 VISUAL RESOURCES

Concerns have been raised over the visual impact of the facilities developed as part of the Proposed Action, in particular the overhead catenary system. The overhead catenary system in most places consists of 8-inch wide flange poles 31 feet high on both sides of the track from which a 12-foot arm is attached. Attached to the arm will be four wires. The poles are spaced approximately 200 feet apart on the average on tangents and closer together on curves. Analyses conducted for the DEIS/R and FEIS/R identified visually sensitive receptors and concluded that the proposed project may impact 42 of the 225 potentially sensitive views. Since the No-Build Alternative scenarios do not involve construction of catenary, they would have no impact in this area of concern.

The relative significance of this impact should be judged in the context of recent history. As discussed under Socioeconomics - Tourism above, the catenary will be built about the same time that the existing signal pole line is removed. The net overall impact on visual resources in most locations should be small.

ES 3.11 NATURAL ENVIRONMENT

Considering the scale of the proposed undertaking, covering 156 miles of linear corridor in three states, the potential impacts on the natural environment of the Proposed Action are small. Since the No-Build Alternative scenarios involve no construction, they would have no impact in this area of concern.

Rare and Endangered Species: One Federally protected species was identified in the study area, the Shortnose sturgeon that resides for parts of the year in the Connecticut River. An analysis of the Proposed Action as it relates to this species' habitat was undertaken as was consultation with the appropriate Federal and state authorities. It was concluded that there would be no adverse impact on this species, provided construction work was avoided during its spawning season. A prohibition to construction in the Connecticut River during that period of the year has been included as a mitigating measure.

Four Massachusetts-listed endangered species, the Spotted and Blandings turtles, the Least bittern, and the Elderberry longhorn beetle have been identified in the general area of the rail right-of-way. However, consultations with appropriate state officials resulted in the conclusion that there would be no effect on these species.

One Connecticut-listed endangered species, the American bittern, has been identified in close proximity to one of the proposed fixed facilities. After consultation with the appropriate state authorities, mitigation will be incorporated into the project (avoidance of construction during the nesting season) to avoid any adverse impact.

A variety of aquatic species identified as Species of Concern occur in the water bodies crossed by the five moveable bridges in the project area. The Connecticut Department of Environmental Protection Fisheries Division applies seasonal restrictions to work in streams to protect these species. This would largely eliminate the potential for impact.

Wetlands: No wetlands will be dredged or filled as part of the construction of facilities for the project. Ten of the 25 fixed facilities will be developed and three of the seven bridge modifications will occur in buffer areas around wetlands and measures will be incorporated as part of the project to minimize siltation, sedimentation or runoff of contaminants that could indirectly impact any wetland.

Between Central Falls and Davisville, RI, Amtrak will design its system to accommodate the possible future construction of a parallel track by the state of Rhode Island to meet the freight service needs of developing a port at Quonset Point. Amtrak's current plan is to use portal structures instead of catenary poles to span the existing and proposed track alignments. Such poles would, in some cases, be outside the existing right-of-way. In three instances, these poles could be located in areas classified as wetlands. Cumulatively, the net wetland loss would total less than 100 sf and compensation for this loss would be negotiated with the appropriate Federal and state agencies. Amtrak is currently exploring another design option, double cantilevered poles, that would be placed in the existing roadbed and avoid any use of wetlands in these areas.

Water Resources: The construction and operation of the Proposed Action's fixed facilities have a small potential for adversely impacting surface and ground water quality. The project will be designed to minimize the potential for adverse impact.

ES 4.0 FRA'S PREFERRED ALTERNATIVE

The analysis of the Proposed Action and the No-Build Alternative scenarios demonstrates many of the benefits to be derived from investing in high-speed rail including a significantly expanded transportation service and improved energy efficiency and air quality. Introduction of high-speed rail service between Boston and New York City will help address congestion at airports and on the highways by diverting substantial intercity passengers from these modes of transportation. This would tend to delay the need for investments in these other modes of transportation. A further benefit of the high-speed rail improvements will be significantly improved conventional service to the many smaller communities between New Haven and Boston. The "do nothing" alternative represented by the No-Build Alternative - AMD-103 Scenario would accomplish none of these objectives and FRA has rejected it.

The Proposed Action is the best alternative available to achieve the benefits from improved intercity rail passenger service between Boston and New York City and to meet the statutory goals of NECIP. None of the alternative

scenarios would offer a higher level intercity rail service or significant environmental advantages when compared to the Proposed Action.

In several areas, most notably potential impacts on commuter and freight rail service, on marine traffic using the five moveable bridges in the study area, and in noise, vibration, and safety, the primary source of adverse impacts is not the Proposed Action per se, but rather the projected growth in the use of this important transportation corridor to provide expanded and enhanced intercity, commuter, and freight rail service. Such impacts could occur without this specific project at some point in the future as shown in the analysis of the No-Build Alternative - FF-125 and FRA-150 scenarios.

In areas directly related to the proposed electrification system, the proven capabilities of a modern electric traction system that would be implemented under the Proposed Action offer superior performance when compared to the proven capabilities of existing, non-electric passenger rail equipment (as represented by the No-Build Alternative - FF-125 scenario). The electric passenger rail service yields greater transportation and environmental benefits with minimal environmental impacts. It will generate greater ridership, consume less energy, and generate less air pollution.

The No-Build Alternative - FF-125 scenario would have no impact on natural, historic, and archaeological resources. However, considering the magnitude of the Proposed Action spread across 156 miles in three states, its potential for adverse impact on these resources is minimal and will be made even smaller by the mitigation measures incorporated as part of this project.

The Proposed Action has the potential to impact in two additional areas of concern that would not be impacted by non-electric alternatives. The first is the potential visual impact of the catenary system. A significant portion of the route passes along some extremely scenic parts of the Connecticut coast line, through natural areas and historic districts. Residents and other interested people are rightly concerned about any new intrusion that would detract from these views. However, the catenary system will not be significantly out of scale with the railroad signal pole system that has been part of the same views for several decades and which is being removed as part of a different NECIP project. In areas where the catenary system passes through historic districts and near historic sites, the placement and color of the poles will be approved by the appropriate State Historic Preservation Officer to ensure minimal effect. Amtrak will also adjust pole placement, where possible, to lessen intrusion into sensitive views. As a consequence, the visual impacts of this Proposed Action should not be significant.

The other area of concern is changes in existing electromagnetic fields (EMF) by the Proposed Action and the possible adverse EMF health effects. Much of the concern in this area arises because there is no clear scientific consensus on the health impacts of EMF.

EMF is not a rail issue, or a transportation issue, but a societal issue that is brought about by the pervasive use of electricity. Many studies of this issue have been undertaken or are in progress. (The number of studies identified by FRA on related topics exceeds 13,000.) Some research efforts indicate a weak causal relationship between different EMF levels and certain health concerns and others do not. This uncertainty raises a concern in a society such as ours where 60 cycle electric current is ubiquitous.

This is not a new issue for FRA. Since 1990 FRA has invested over $1.8 million in the study of EMF. It has supported research efforts and cooperated closely with the U.S. EPA and the Department of Energy in the measurement of EMF generation by rail transportation sources and in the analysis of the health implications of the types and levels of EMF encountered in transportation.

With regard to this specific project, the overhead catenary system and power transfer facilities design have been shown to minimize environmental EMF along the right-of-way, with no adverse effects documented in over a decade of operation of a similar system used to power the *TGV* system in France. Projections of EMF levels on and adjacent to the right-of-way that will result from the Proposed Action will be significantly lower than the most relevant exposure guideline. Based on the current state of scientific research and the relationship of EMF levels

projected to result from the Proposed Action and current guidelines, there is no basis not to proceed with this project based solely on EMF concerns.

Recognizing that EMF is an issue where significant scientific study remains to be done, FRA plans to continue its research into EMF. With cooperation from Amtrak and any interested state health or environmental agency, a continuing program will be established to monitor EMF levels associated with electric intercity rail operations. Should, at some point, future research indicate a health- or safety-related need to reduce or mitigate EMF beyond the measures incorporated into this project, FRA will be in a position to facilitate implementation of any needed modifications to then-existing electric traction systems.

Based on an analysis of the relevant factors, FRA has concluded that the No-Build Alternative - FF-125 scenario does not offer significant advantages, either from a program or environmental standpoint, to the Proposed Action and it too is rejected.

The No-Build Alternative - FRA-150 scenario was shown to have the potential to closely approximate in many areas the Proposed Action's quality of service and ability to provide the high-speed rail transportation benefit with minimal environmental impact. At the same time it would avoid the visual impact and EMF issues. The key word here is <u>potential</u>.

The FRA-150 scenario is representative of many innovative ideas that have been presented to FRA over the last several years for advancing the state-of-the-art of high-speed non-electric locomotives and trainsets. FRA believes that there is merit in developing a high-speed non-electric locomotive/trainset that has the capabilities of the best electric powered equipment and that would improve on the shortcomings of previous non-electric equipment. Such equipment would have an important role in the development of high-speed service on intercity corridors throughout the country. For that reason, FRA has included as part of the Administration's high-speed rail initiative a program to facilitate development of such equipment. However, there are significant uncertainties associated with this effort that eliminate the FRA-150 scenario as a viable alternative to the Proposed Action.

The first uncertainty is technical. There is an element of risk associated with research and development programs. Ambitious goals are often not met. The ability of any design to meet FRA's goals will not be known until a prototype is built and tested. Although FRA has been approached by numerous companies and persons proposing new high-speed systems or components of such systems, all have stated that substantial Federal funding is required to complete final designs, build, and test prototype equipment. The inability to fund such efforts in the private sector is an indication of the risk involved.

The second uncertainty is funding. In an era when discretionary Federal funding is diminishing, not all meritorious programs are funded. The Administration's budget request for the 1994 fiscal year included $10 million for the high-speed non-electric locomotive program. No funds were appropriated for this purpose. The Administration's budget request for this program for the 1995 fiscal year is $6.5 million. At the time the FEIS/R was completed, final action has not been taken on this request. In passing their separate versions of the Department of Transportation and Related Agencies Appropriations Act for Fiscal Year 1995, the House of Representatives provided $3 million and the Senate provided no funds for this program. There clearly is a significant degree of uncertainty as to whether there will be the continuing commitment of financial resources necessary to see this program through to a successful conclusion.

Conclusion

In selecting between the two alternative approaches to achieve high-speed service between Boston and New York City, the choice comes down to moving forward today to implement the proven high-speed capabilities of electric traction, or postponing a decision for an indefinite period of time and waiting to evaluate the results of a development program facing technological and financial uncertainties. During such a period, the latter choice delays for what could prove to be an extensive period of time the realization of the substantial transportation and environmental benefits of improved intercity rail passenger service. In FRA's view, this represents an adverse environmental impact that could not be effectively mitigated. Even optimistic views of the non-electric locomotive program do not suggest it will yield results significantly superior to the proven capabilities of electric traction. As a consequence, FRA has selected as its preferred alternative implementing the Proposed Action, as modified by the mitigating measures contained in Chapter 5 of the FEIS/R.

CHAPTER 1
INTRODUCTION:
PURPOSE AND NEED

This document is the final environmental impact statement (FEIS) and final environmental impact report (FEIR) on the proposal by the National Railroad Passenger Corporation (Amtrak) to complete the electrification of the Northeast Corridor main line by extending electric traction from New Haven, CT, to Boston, MA.

A combined draft environmental impact statement (DEIS) and draft environmental impact report (DEIR) was published by the Federal Railroad Administration (FRA) in October 1993, and filed with the U.S. Environmental Protection Agency (EPA) and the Massachusetts Executive Office of Environmental Affairs (EOEA). The public was afforded the opportunity to review and comment on the DEIS/R in writing during FRA and Massachusetts Environmental Policy Act (MEPA) public review processes from October 15, 1993, to January 21, 1994. In addition, public hearings were held on November 16 in Boston, MA (afternoon and evening meetings), on November 17 in Cranston, RI (afternoon and evening), and on November 18 in Old Saybrook, CT (afternoon), and New London, CT (evening). Two MEPA consultation sessions were held on January 12 (evening) and 13 (afternoon) near Roxbury Crossing in Boston.

All comments have been considered. In some cases design refinements were made, additional analyses were performed, and further explanations of potential impacts incorporated into this document as a result of those comments. Based on the analysis contained in this FEIS/R and other relevant considerations, FRA has selected the Proposed Action, as mitigated by provisions contained in Chapter 5 of this report, as its preferred alternative.

1.1 PURPOSE AND NEED FOR THE FEIS AND FEIR

Congress has appropriated funds to FRA for transfer to Amtrak for the purpose of extending electric traction power to Amtrak's Northeast Corridor (NEC) main line between New Haven, CT, and Boston, MA. FRA has determined that the transfer of these funds would constitute a "major Federal action" within the meaning of the National Environmental Policy Act of 1969 (NEPA). Pursuant to the regulations of the President's Council on Environmental Quality (CEQ), which sets out the procedures for implementing NEPA (40 CFR Parts 1500-1508), and FRA's *Procedures for Considering Environmental Impacts* (FR Vol. 45 page 40854), FRA has prepared this Final Environmental Impact Statement to document its analysis of the environmental issues associated with implementing Amtrak's Proposed Action.

This document has also been prepared in accordance with the procedures for implementing MEPA set out in 301 CMR 11.00 and in certificates issued by the Massachusetts Secretary of Environmental Affairs on September 9, 1992, and January 28, 1994. This document also serves as the Final Environmental Impact Report, as required in the Secretary's certificate, for a joint FEIS/R.

The FEIS/R supplements the final Programmatic Environmental Impact Statement (PEIS) on the Northeast Corridor Improvement Project (NECIP), published by FRA in 1978. The PEIS was an evaluation of alternatives associated with possible investments by the Federal government necessary to improve intercity ground transportation between Washington, DC, and Boston, via New York City and New Haven. Based in part on the PEIS, FRA made a decision to undertake a comprehensive program of improvements to the NEC main line (the history of NECIP is discussed in Section 1.4). Included in this program was the extension of electric traction (electrification) between New Haven and Boston. Electrification was addressed in the PEIS at a level commensurate with that document's focus on broader issues. FRA determined that a more detailed site-specific

environmental analysis would be prepared prior to release of Federal funds to implement this aspect of the program.

As major project elements of NECIP progressed, site-specific environmental analyses similar to this one have been undertaken. To date approximately 160 such site-specific analyses have been completed.[1] In addition to this FEIS/R, FRA is currently conducting two NECIP-related environmental reviews, one for the proposed "flyover" near New Rochelle, NY, and the other for the proposed conversion of the James A. Farley Post Office Building in New York City into a new intercity passenger rail station. In addition, the Federal Highway Administration (FHWA), FRA, and the Rhode Island Department of Transportation (RIDOT) are preparing an EIS on a proposal to construct a track parallel to the NEC main line in Rhode Island to support the state's efforts to develop a new port facility at Quonset Point, RI.

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

The Proposed Action, extension of electric traction between New Haven and Boston, is part of the continuing program of improvements to the main line of the NEC known as the Northeast Corridor Improvement Project. This rail corridor is a major part of the transportation system in the most heavily populated and congested regions of the United States. NECIP is designed to improve rail passenger service on the Washington-New York City-New Haven-Boston route through reduced travel times and increased reliability.

Reduced travel times and improved comfort and service reliability would increase the attractiveness of rail travel over alternate means with resulting transportation and environmental benefits. The potential diversion of automobile and air traffic in the Northeast Corridor could reduce vehicular traffic on major highways and surface roads serving the region's major airports and slow down the growth of air traffic, easing air traffic congestion. These transportation benefits, in turn, would yield important regional and community air quality, energy efficiency, land use, and noise level benefits. Such improvements would be consistent with important Federal and state environmental objectives, including those specified in the 1990 Federal Clean Air Act Amendments (CAAA) mandating use of transportation technologies to improve air quality.

As discussed in Section 1.4, NECIP is a comprehensive program of improvements to the main line of the NEC. The current statutory goals for NEC high-speed service are the provision of regularly scheduled, safe, and dependable rail passenger service in 2.5 hours between Washington, DC, and New York City, and in 3 hours or less between New York City and Boston with appropriate intermediate stops.[2]

The Proposed Action has been a long-standing part of plans to improve rail passenger service between Boston and New York City. Presently, the New Haven to Boston segment of the NEC is the only segment not electrified. The segment between New York City and Stamford, CT, was electrified with the world's first overhead catenary system by 1909 and this was extended to New Haven by 1914. The NEC main line from Washington to New York City was electrified between 1928 and 1935.

All modern high-speed rail systems worldwide, including the Japanese *Shinkansan*, the French *Train Grand Vitesse (TGV)*, the German *InterCity Express (ICE)*, the Swedish *X-2000*, the British *Intercity 225*, the Spanish *AVE*, the Italian *ETR 450* and *ETR 500*, and the Amtrak *Metroliner*, are powered through an overhead catenary electric traction system. Systems under development in the European Community, Canada, China, Korea, and Taiwan are also planned to use this form of power. Electric-powered trains have operating characteristics (e.g., maximum speed, acceleration and deceleration rates, reliability, and cost of maintenance) that make them superior to other forms of railroad traction presently in service or under development.

In the context of improved rail passenger service between Boston and New York City, electric traction also addresses site-specific operational concerns. The first is the trip time delay associated with switching from non-electric (diesel) locomotives to electric locomotives at New Haven. The second is the severe capacity constraints in the New York City railroad tunnels and at Pennsylvania Station which would be exacerbated by additional non-electric trains using electric third rail. The third is the ability to improve Amtrak equipment utilization by

improving the efficiency of Washington to Boston through service. In addition, electrically powered railroads offer energy and air quality advantages over available alternatives.

Extension of electric traction between Boston and New Haven has been the consistent recommendation of studies on providing improved high-speed rail passenger service in the NEC.[3] Such recommendations have also been consistently incorporated into congressional guidance and direction on improving rail service on the NEC. Voting to authorize the acquisition of the NEC by Amtrak in 1973 for provision of improved rail passenger service, the Senate Commerce Committee stated: "The implementation of this improved high speed rail passenger service will also further the use of rail passenger transportation, the most energy efficient passenger transportation mode. Because the improved system outlined by the Department of Transportation will be **electrically powered** (emphasis added), increased rail use by intercity passengers in the Northeast will impact favorably upon ambient air standards."[4]

In voting to create the Northeast Corridor Improvement Project, the House Committee on Interstate and Foreign Commerce stated: "The program implementation of the Corridor project requires restoration and upgrading of the Corridor which would include work in the following categories which are briefly described--... *Electrification*.-Improved electrification will involve modernization of existing electric traction by converting to 60Hz, 25kV power, modification of substations to connect to commercial power grid, and selective rehabilitation of catenary. **The other part of the electrification program will consist of the extension of this modernized system from New Haven to Boston** (emphasis added). Increased bridge clearances and revised signal circuits will also be required to accommodate improved electrification."[5]

In the Department of Transportation and Related Agencies Appropriations Acts for each of the fiscal years 1991, 1992, 1993, and 1994, Congress has specifically earmarked a portion of the appropriation to undertake the design and construction of electrification between New Haven and Boston. As of the date of this FEIS/R, both the Senate and the House of Representatives have voted to provide additional funds in fiscal year 1995 earmarked for the extension of electrification between New Haven and Boston.

In summary, completion of the electrification of the main line of the NEC is an integral part of Amtrak's efforts to meet the statutory goals of NECIP to provide fast, safe, and reliable intercity rail passenger service between Boston and New York City.

1.3 DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action involves the installation, over existing tracks, of a constant tension, catenary system, comprised of one messenger wire, one electrical contact wire, one static wire, and one negative return wire, which would deliver 25,000 volts (25 kV) at 60 hertz (Hz), or cycles per second, to the electric locomotive unit or units. Four traction power substations would be installed along the railroad route, which would receive power via a 115 kV-60 Hz connection, step down the voltage to 25 kV-60 Hz, and transmit the power to the catenary contact wire. Each substation would require a site of approximately 0.5 acre. Power would be supplied to the substations from the existing commercial power grid, over lines funded under this project. Switching stations would be constructed on sites of approximately 0.25 acre in area, at three locations between the traction power stations. Finally, 18 paralleling stations would be constructed along the railroad right-of-way (ROW), each requiring an area of approximately 0.15 acre. A more detailed description of these facilities is provided in Chapter 2 of this FEIS/R.

The catenary would be supported by poles erected on both sides of the existing tracks within the railroad property line. The poles would be installed approximately 200 feet apart on tangent sections and at shorter intervals on curved track. Each pole would have a cantilevered arm assembly extending over the track which would position the contact wire 21.5 feet above the rail. In areas where more than two tracks are involved, portal structures, in which a solid beam spans the two poles, may be used. Where necessary, the vertical clearance at overhead roadway bridges would be increased by undercutting (lowering) the track, by raising the bridge structure, by special treatment of the catenary assembly, or by some combination of these three actions. The 21.5-foot

clearance would be reduced on a site-specific basis, e.g., within tunnels and in critical overhead bridge areas, within the parameters of governing design guidelines.

Construction of the proposed project would begin in March 1995, with completion anticipated for the fall of 1998.

1.4 PROJECT BACKGROUND

1.4.1 History and Status of the Northeast Corridor

The Northeast rail corridor evolved from a number of railroads independently constructed and operated prior to the American Civil War to, by the turn of the century, a unified system organized under the Pennsylvania Railroad Company (between New York and Washington) and the New York, New Haven and Hartford (New Haven) Railroad Company (between New York and Boston). The New Haven to Boston Shore Line, the subject of this FEIS/R, was unified under the control of the New Haven Railroad Company in 1893.

In the first decade of the 20th century the completion of a railroad tunnel under the Hudson River linked the Pennsylvania system with Manhattan Island and Long Island. The Hell Gate high-level railroad bridge, constructed in 1917, allowed passengers to travel between Boston and Washington on a "one-seat ride" although, until 1970, most New Haven Railroad intercity passenger service and all commuter passenger service terminated at Grand Central Terminal in New York City. Amtrak rerouted all Boston to New York City trains to Pennsylvania Station in the 1970s, providing for through NEC service.

Following an accident in the Grand Central Terminal tunnel in the early 1900s, the railroads operating into this station were required to convert from steam locomotives to electric power. The New Haven Railroad installed an overhead catenary system from New York City to Stamford, CT, by 1909 and extended this system to New Haven by 1914. The route between Washington and New York City was electrified between 1928 and 1935.

After 1935, the Pennsylvania and New Haven railroads cooperated in the operation of electrically powered passenger service, although each railroad used its own electric locomotive to and from Pennsylvania Station. Except for a brief period of prosperity during World War II, the New Haven Railroad experienced a long decline in both passenger and freight volumes. This resulted from several factors: (1) changes in the southern New England economic base; (2) the creation of the Interstate Highway System; and (3) the expansion of aggressive airline competition. After entering into bankruptcy in 1961, the railroad remained under court supervision until it was incorporated into the Penn Central Railroad (successor to the Pennsylvania Railroad) system in 1969. After the merger of the two railroads, Penn Central electric locomotives hauled passenger trains, with no change of locomotive units, between New Haven and Washington.

Shortly after its creation, the Penn Central Railroad also fell into bankruptcy which, in turn, precipitated the Northeast rail crisis. In moving to address this crisis, Congress passed several pieces of legislation that sought to restructure the railroads in the Northeast and Midwest as well as restructuring the Federal Government's role in regulating the railroads.

First, the Rail Passenger Service Act (RPSA) was passed in 1970 to prevent further deterioration of intercity rail passenger service, facilitate an upgrade of passenger service, and improve the potential viability of passenger service between major population centers. Section 101(a) of this act asserts "...that rail passenger service can help in alleviating the overcrowding of airways, airports, and highways..." The RPSA created the National Railroad Passenger Corporation to assume responsibility for providing intercity rail passenger service in the U.S.

In 1973, the Regional Rail Reorganization Act (3R) was enacted. While the 3R Act was concerned primarily with rail freight transportation, it also directed the Secretary of Transportation to begin engineering studies necessary to implement "...improved high-speed rail passenger service..." within the NEC. As a result of this act and the subsequent Railroad Revitalization and Regulatory Reform Act of 1976, Amtrak acquired the Northeast Corridor

except for the portion between New Rochelle and Port Chester, NY, which was acquired by the Metropolitan Transportation Authority of New York, the portion between Port Chester and New Haven which was acquired by the Connecticut Department of Transportation (ConnDOT), and the portion in Massachusetts which was acquired by the Massachusetts Bay Transportation Authority (MBTA).

1.4.2 History of the Northeast Corridor Improvement Project

Following the end of World War II, passenger losses to air and highway travel, combined with the financial inability of the railroads to make the levels of investment necessary to maintain adequate passenger service, prompted Congress in 1963 to establish an NEC Project Office within the Department of Commerce. A program was developed to gather data about travel needs, the condition of rail facilities, and "state-of-the-art" modern railroad equipment for NEC operations. Through the High Speed Ground Transportation Act of 1965 (HSGTA), the Office of High Speed Ground Transportation (OHSGT) was established.

The major aim of the HSGTA was to sponsor research, development, and demonstration of possible high-speed ground transportation. Under this program, the OHSGT prepared specifications used by the Pennsylvania Railroad (later Penn Central Railroad) in the purchase of *Metroliner* cars for demonstration and later use between Washington and New York City. OHSGT also contracted with United Aircraft Corporation for the demonstration of two gas turbine-powered lightweight tilt trainsets known as *Turbo Trains* primarily between Boston and New York City. The OHSGT was transferred to the Department of Transportation (DOT) following that Department's creation in 1967 and was incorporated as part of FRA.

Another product of the 1965 legislation was an effort to analyze the transportation needs of the Northeast and to make recommendations. This was known as the Northeast Corridor Transportation Project. The final report of this project, *Recommendations for Northeast Corridor Transportation*, was published in September 1971. In that report, the Secretary of Transportation found that high-speed rail represented one of the best alternatives for short and long-term future transportation needs in the NEC. It also set 1976 as the decision year for establishing an intercity transportation investment program for the 1980s. A 1973 update of the report proposed implementation of passenger service improvements in the NEC. Specific improvements, an organization, a financial plan, and a schedule for implementation were recommended. Among the improvements recommended was extension of electrification between New Haven and Boston.

The Railroad Revitalization and Regulatory Reform Act of 1976 (4R) authorized a $1.75 billion program to implement faster, more frequent, more reliable, and more attractive intercity passenger service along the NEC. Congress subsequently increased this authorization to $2.5 billion and, since 1991, has authorized annual expenditures for NECIP in excess of $200 million. FRA was designated as the program manager for NECIP and undertook the required environmental analysis. In June 1978, the Final PEIS was issued. The PEIS detailed a preferred system of projects necessary to reduce travel times for NEC passengers. Included in that program was extension of electrification between New Haven and Boston.

Following the Federal environmental review and approvals, FRA embarked on a comprehensive construction program, which to date has resulted in the expenditure of approximately $3 billion including approximately $1.1 billion on infrastructure improvements between New Haven and Boston. This construction involved: laying of 481 miles of continuously welded rail; installation of 2 million new crossties; undercutting of 504 miles of track; elimination of 49 grade crossings; construction or rehabilitation of 13 passenger stations; upgrade and rehabilitation of power, communications, and signal systems, and railroad bridges; creation, improvement, or expansion of nine rolling stock and maintenance of way facilities; and creation, rehabilitation, or removal of over 100 interlockings. Beginning in 1982, the appropriations made available for NECIP declined rapidly. Adequate funds were not available to proceed with electrification and a decision was made to defer this project.

In 1980, Congress directed FRA to transfer to Amtrak all authority and responsibility for NECIP effective September 30, 1985. Presently, funds for NECIP improvements are appropriated to FRA and transferred to Amtrak pursuant to a grant agreement.

1.4.3 Current Status of the Northeast Corridor Improvement Project

In the late 1980s, a number of groups, most notably the Coalition of Northeastern Governors (CONEG), pressed for faster railroad passenger service between Boston and New York City. In response, Congress increased the appropriations for NECIP beginning in fiscal year 1991, primarily for the purpose of improving the NEC north of New York City. Since 1991, Congress has appropriated $829 million for this purpose, including $292.8 million earmarked for the electrification project.

1.4.4 Other Site-Specific NECIP Projects

1.4.4(a) Northeast Corridor Transportation Plan

The proposed electrification project is just one of several projects that Amtrak proposes to undertake to achieve the statutory trip time goal. In addition, the states and other railroads operating over the NEC between Boston and New York City propose to undertake projects to improve commuter and freight rail service. Recognizing the multiple uses and interests in the NEC main line and the potential for conflicts between projects planned as part of NECIP and projects planned for other rail users, Congress, in Section 4 of the Amtrak Authorization and Development Act (Pub. L. 102-533, October 27, 1992), directed FRA to develop "...a Program Master Plan for a coordinated program of improvements to such main line that will permit the establishment of regularly scheduled, safe, and dependable rail passenger service between Boston, Massachusetts, and New York, New York, including appropriate intermediate stops, in three hours or less."

In compliance with this Congressional directive, in July of 1994, FRA completed and transmitted to Congress the Northeast Corridor Transportation Plan (NECTP).[6] This plan identified the needed improvements to the NEC main line between Boston and New York City, divided into three separate categories: trip time improvements, capacity improvements, and recapitalization projects. The latter category refers to the replacement of aging infrastructure required regardless of the future level of service on the NEC main line. Table 1.1-1 provides a list of these improvements. Copies of the NECTP have been provided to libraries along the Northeast Corridor.

These projects are separate and distinct from the electrification project that is the subject of this FEIS/R. To the extent that they have not been addressed in the PEIS or in previous site-specific environmental reviews, they will become the subject of additional site-specific reviews by FRA, FHWA, or the Federal Transit Administration (FTA) at times consistent with project development.

TABLE 1.1-1 Northeast Corridor Transportation Plan

a. High-Speed Trip Time Improvements

PROJECT	ESTIMATED COST (millions of 1993 $)
Clearance for Electrification	30.4
25kV 60 Hz Center-Fed System	328.7
Signals Compatible with High-Speed Electric Operations (including N.H.-Prov. CETC)	102.3
Amtrak High-Speed Trainsets	185.9
Positive Stop/Civil Speed Enforcement	67.7
Curve Realignments	64.9
Track Program	161.6
Canton Viaduct Improvements	9.1
Grade Crossing Program	27.8
Reconfigure Shell Interlocking	75.7
Stamford Station Island Platforms	55.2
Reconfigure New Haven Terminal	87.5
Amtrak New Haven Service Facility	12.9
Replace Miter Rails	12.9
Reconfigure Old Saybrook Station	8.3
Kingston Station Transfer Facility	2.4
Route 128 Improvements	7.1
Approach Warning System	2.2
Noise and Vibration Mitigation	12.5
TOTAL	**$1,255.10**

TABLE 1.1-1 Northeast Corridor Transportation Plan (continued)

b. Capacity Improvements

PROJECT	ESTIMATED COST (millions of 1993 $)
Penn Station Improvements	27.6
Reconfigure Harold Interlocking	124.1
South Station Capacity Improvements	48.9
Devon-New Haven 4th Track	25.4
SLE Passing Sidings	36.3
SLE Both Sides Fully Accessible	18.3
N. London-Providence Passing Sidings	15.9
Providence-Boston Passing Sidings	61.5
Reconfigure Existing Interlockings	32.6
HS Universal Interlockings	16.3
Gauntlet Tracks	15.6
New Interlockings	14.9
Canton Jct.-Boston Signal Modifications	2.6
Construct High-Level Platforms	25.7
3rd Track Boston Switch-Cranston	18.1
Medium/Heavy Overhaul Facility	38.6
Amtrak Boston Service Facility	40.1
Cab Signal Equipment Modifications	43.9
TOTAL	**$606.40**

TABLE 1.1-1 Northeast Corridor Transportation Plan (continued)

c. Recapitalization

PROJECT	ESTIMATED COST (millions of 1993 $)
Pelham Bay Bridge Replacement	12.3
Walk Bridge/Saga Bridge Replacement	191.9
Peck Bridge Replacement	123.2
Niantic Bridge Replacement	25.5
Groton Bridge Replacement	40.3
Open Deck Bridge Conversions	338.0
Deteriorated Bridges and Culverts	95.7
Rhode Island Overhead Bridges	33.8
Hell Gate Line Hanging Beam Replacement	11.1
NHL Substation Replacement	42.8
NHL Catenary Replacement	145.5
Commuter Equipment Testing	4.6
Fence Selected Sensitive Areas	16.7
Penn Station/E. River Tunnel Fire Safety	145.5
Step & Touch Traction Return Mitigation	3.6
TOTAL	**$1,230.50**

1.4.4(b) NEC Rail At-Grade Crossings

There are presently 16 highway at-grade crossings of the NEC, all located between New Haven and Boston. Congress, in Section 2 of the Amtrak Authorization and Development Act (Pub. L. 102-533, October 27, 1992), directed FRA to prepare a plan for the elimination of all highway at-grade crossings by December 31, 1997. This plan is incorporated into the Northeast Corridor Transportation Plan as Appendix A. Table 4.8-2 lists the recommendations contained in the plan with regard to each grade crossing.

The legislation directing FRA to develop this plan did not authorize or fund implementation of the plan. Projects to eliminate public grade crossings on the NEC main line to date have been undertaken by the states. It is expected that the same will hold true for the remaining crossings. Therefore, decisions on whether or when to implement this plan will be made by the respective states under their existing procedures. Such actions are separate and distinct from the proposed extension of electric traction that is the subject of this FEIS/R. Should a state decide to implement all or a portion of the grade crossing plan, appropriate site-specific environmental reviews will be undertaken at that time.

1.4.4(c) Planned Service Improvements

The improved trip times between Boston and New York City that will result from NECIP will significantly increase the demand for intercity rail passenger service. To meet this demand, Amtrak plans to increase the level of service it offers from 10 round trips per day in 1994 to 26 round trips per day in 2010 consisting of 16 express and 10 conventional (local) round trips. Preliminary schedules for this service are presented in Table 4.9-3.

Amtrak is in the process of acquiring new electric trainsets to replace the equipment presently used for *Metroliner* service between Washington, New York City, and New Haven. Upon completion of the proposed electrification project, this equipment will be used for through express service between Washington and Boston. For a transitional period lasting several years, conventional trains will likely consist of the AEM-7 or E-60 locomotives and Amfleet cars presently used in electrified Northeast Corridor service.

1.5 RELEVANT PARTIES

Several parties are participating in the design and environmental analysis of the Proposed Action:

- *The Federal Railroad Administration* is an operating administration within the U.S. DOT vested with the primary responsibility for national railroad policies and programs. Federal funds for Amtrak capital improvement projects such as NECIP, and for operating expense subsidies of the Amtrak railroad network are appropriated to FRA, which transfers these funds in the form of grants to Amtrak.

  FRA is responsible for the preparation and approval of this FEIS/R. FRA may release Federal funds to finance construction activities for the electrification project only after completion of the FEIS/R.

- *The John A. Volpe National Transportation Systems Center* (Volpe Center) is part of the Research and Special Programs Administration of the DOT. The Volpe Center is providing technical support to FRA in the preparation of this FEIS/R.

- *Daniel, Mann, Johnson, and Mendenhall, Inc., and Frederic R. Harris, Inc.* (DMJM/Harris) is a joint venture of two planning, engineering, and environmental analysis firms, engaged by the Volpe Center to assist in the analysis of the electrification project and to prepare the FEIS/R.

- *The National Railroad Passenger Corporation* is a private corporation, created by Congress and charged with the operation of the national network of intercity railroad passenger service, including the NEC. In recognition of the substantial and continuing financial support provided to the Corporation, the Federal government appoints the Corporation's Board of Directors, and

the Secretary of Transportation is an *ex officio* member of this Board. Amtrak is responsible for the design and construction of the electrification project.

- *Morrison Knudsen Corporation, L.K. Comstock Corporation, and the Spie Group* (MK) is a joint venture of three engineering and construction firms contracted by Amtrak to design and install all railroad electric power system components necessary to operate high-speed electric locomotive-hauled passenger trains between Boston and New Haven.

1.6 DESCRIPTION OF THE CORRIDOR

The NEC main line is the railroad route connecting South Station in Boston, MA, with Union Station in Washington, DC, serving the most densely populated area of the United States and carrying the greatest intercity passenger volumes of any route in the nation. The route is approximately 457 miles in length. The 156-mile segment between New Haven, CT, and Boston, MA, is also known as the Shore Line.

The Shore Line contains a diversity of land uses and geographical features. In Connecticut, the route generally follows the narrow and irregular coastal plain bordering Long Island Sound, meandering along an alignment between the coastline and a distance of 2 to 3 miles inland. The desire to follow the most favorable topography is evident in the many curves and water crossings of the alignment. Similarly, the alignment crosses tidal basins and wetlands in an effort to avoid tunnel and open-cut excavations that would have been necessitated by routes farther inland.

The route departs from the coastal plain on the segment between the Rhode Island border and East Greenwich, RI. The horizontal curves in this area are less severe and the route transitions to longer tangent sections in the woodland and farm areas. The line continues as a relatively tangential route through Warwick and Cranston, where it abuts the cove areas of Narragansett Bay. The route through Providence, Pawtucket, and Central Falls bisects urban neighborhoods and becomes increasingly curved, necessitating slower train speeds in these cities. The alignment improves again in Massachusetts as it passes through outer suburban and rural land uses. The route continues along a mildly curved alignment as it enters Boston at Hyde Park. The alignment then enters a deep cut section, known as the Southwest Corridor, through the Jamaica Plain, South End, and Back Bay neighborhoods before terminating at the Boston South Station Terminal Building in the city's center.

The Shore Line consists of a two-track main line with some stretches of side track for all but the northernmost 9 miles which are comprised of three tracks; and between Boston Switch (near the Massachusetts border) and Providence Station which varies between three and five tracks. The entire alignment would be electrified, including much of the track within Southampton Yard in South Boston which is the maintenance, storage, service, and turnaround facility for Amtrak's operations on the NEC.

There are 225 roadway bridges over the tracks; five moveable railroad bridges over the Connecticut River, the Niantic River, Shaw's Cove, the Thames River, and the Mystic River; and 220 railroad bridges over roads, railroads, walkways, and watercourses. The moveable bridges over Shaw's Cove and the Mystic River are less than 15 years old. The structures over the Connecticut River and Thames River underwent rehabilitation during the past 15 years. The moveable bridges over the Niantic and Thames Rivers have been identified as needing replacement. The fixed track bridges vary in age and condition; several were constructed during the 19th century, including the historic Canton Viaduct which opened in 1835; others were constructed more recently. Thirty-eight open deck structures are programmed for conversion to ballasted deck bridges as part of NECIP.

Amtrak, the MBTA, and ConnDOT operate passenger train service along the NEC in the study area. Amtrak service between New Haven and Boston takes between 2 hours and 30 minutes and 3 hours and 21 minutes. The MBTA funds commuter train operations between South Station in Boston and Union Station in Providence, through a contract with Amtrak, for five trips in each direction on each weekday. In 1990, ConnDOT contracted with Amtrak to run commuter service comprised of six trains southbound and eight trains northbound along the 33-mile segment between New Haven and Old Saybrook.

The Consolidated Rail Corporation (Conrail) and the Providence and Worcester Railroad Company (P&W) operate freight service along the corridor. Conrail, successor to the Penn Central Railroad, serves customers as part of the agreement that transferred the NEC rail line in Massachusetts to the MBTA. P&W conducts freight operations within Rhode Island and Connecticut. In accordance with normal railroad practice, passenger train operations have scheduling priority over freight trains.

1.7 DIFFERENCES BETWEEN THE FEIS/R AND DEIS/R

There are differences between the FEIS/R and the DEIS/R, published in October 1993. The design of the Proposed Action has undergone some changes, and these are reflected in the FEIS/R. The current design also takes into account some of the environmental concerns identified in comments on the DEIS/R. Such changes to preliminary designs reflect one of the purposes of the environmental review process, to identify potential impacts and opportunities to mitigate these impacts. A primary example is the relocation of the Noank Paralleling Station out of a local beach parking lot, thus avoiding the use of this recreational area.

Specifically, modifications to facility sitings are as follows:

- Relocation of the Branford Substation
- Relocation of the Westbrook and Richmond switching stations
- Relocation of the Millstone, Noank, Elmwood, Providence, Canton, and Readville paralleling stations
- Relocation of the utility feed corridor to the New London Substation

The environmental impacts of these design refinements are examined in the FEIS/R.

The reconstruction of two bridges -- the Depot Street Bridge in Sharon, MA, and the Route 138 Bridge in South Kingstown, RI -- are removed from Amtrak's Proposed Action, as the respective highway departments in Massachusetts and Rhode Island are addressing modifications to these bridges as state projects. Environmental reviews related to these bridge projects are being prepared by the appropriate state highway department.

The FEIS/R also addresses the many comments received from government agencies and organizations, as well as from several hundred individuals.

1.8 ORGANIZATION OF THE FEIS/R

The FEIS/R is divided into four volumes, the main text and support documents. Volume I contains the following information:

- Chapter 1 includes an introduction to NECIP, the Proposed Action, and the purpose and need for the project.

- Chapter 2 describes the Proposed Action and alternatives (both routes and technologies), and the criteria used for selection of the Proposed Action.

- Chapter 3 provides an overview of the existing natural, physical, and socioeconomic environmental conditions in the project area.

- Chapter 4 describes by category the beneficial and adverse long-term environmental impacts of both the Proposed Action and the No-Build Alternative, and the short-term construction impacts. It also includes the criteria and methodology used to identify and evaluate these impacts.

- Chapter 5 summarizes the impacts of the Proposed Action and the No-Build Alternative, and presents the measures that will be incorporated into the Proposed Action as mitigation for potential adverse effects. It details the relationship of short-term uses versus long-term productivity; the irreversible and irretrievable commitments of resources; and the permits required for implementation of the project.

- The Glossary of Terms and List of Abbreviations are provided for readers' reference.

- Appendices A through L include: Electrification Facilities and Bridge Modification Sites; Chapter 3 Tables; Public Participation Program, MEPA Certificates; Memorandums of Agreement between FRA, the State Historic Preservation Officers, and the Advisory Council on Historic Preservation on the mitigation of impacts to historic resources; List of Agencies, Organizations, and Persons from whom comments were received on the DEIS/R; List of Preparers and Reviewers; the Final Section 4(f) Statement for the siting of the Kingston Paralleling Station; List of Agencies, Organizations, and Persons receiving this FEIS/R; Key Correspondence; Siting Analysis for Connecticut Substation Alternatives, and; Siting Analysis for Roxbury Substation Alternatives.

Volume II contains several technical support studies that provide an additional level of detail not included in the main body of the FEIS/R. This technical appendix substantiates analyses fundamental to the impact statement and is available upon request.

Volume III provides the comments received from agencies, organizations, and individuals during the public review and comment period, and responses to them.

Volume IV reproduces all comment letters and public hearing testimony received during the DEIS/R comment period.

The DEIS/R Volume II, an atlas of color maps of the project area illustrating natural and historic resources along the alignment, and Volume III, Technical Studies, are not reprinted as part of this FEIS/R.

Endnotes

1. Major NECIP-related site-specific NEPA reviews conducted in the New Haven-Boston study area include:

- FONSI improvements to Groton Bridge
- FEIS replacement of Shaw's Cove Bridge
- FEIS replacement of Niantic Bridge
- ND improvements to CT River Bridge
- FEIS replacement of Mystic Bridge
- FONSI restoration of New Haven Station
- FONSI restoration of New London Station
- FEIS construction of Providence Station
- FEIS construction of Providence railroad and station improvements
- FEIS improvement of Boston South Station
- ND improvement of Boston service facility
- ND construction of Providence MOW base

(FONSI = Finding of No Significant Impact, ND = Negative Declaration, the earlier designation for FONSI)

2. Section 703(1)(E) of the Railroad Revitalization and Regulatory Reform Act of 1976 (4R Act, 45 U.S.C. 853(1)(E) now recodified at 49 U.S.C. 24902) and Section 708 of the 4R Act (45 U.S.C. 856 now recodified at 42 U.S.C. 24903).

3. As examples see: *Final Report Washington -- Boston Transportation Study,* MRD Division, Great American Transportation Corporation, D. Clejan, et al., for the Office of the Under Secretary of Commerce for Transportation, November 1963.

Louis T. Klauder and Associates for the U.S. Department of Commerce Northeast Corridor Transportation Project, *Preliminary Engineering Report on Possible Improvements to Railroad Passenger Service Between New York and Boston*, November 15, 1965.

Feasibility of High-Speed Rail Service, Systems Analysis Research Corporation and Thomas K. Dyer, Inc., for the New England Regional Commission, October 1969.

Recommendations for Northeast Corridor Transportation -- Final Report, U.S. Department of Transportation, Assistant Secretary for Policy and International Affairs, September 1971.

Improved High-Speed Rail for the Northeast Corridor, U.S. Department of Transportation, January 1973.

Northeast Corridor Improvement Project -- Final Programmatic Environmental Impact Statement, U.S. Department of Transportation, Federal Railroad Administration, June 1978.

CONEG High Speed Rail Regional Benefits Study, Parsons Brinckerhoff Quade and Douglas, Inc., Cambridge Systematics, Inc., and Regional Science Research Institute, Chapter 3, October 1990.

4. *Rail Services Act of 1973, Report of the Senate Committee on Commerce together with additional Views on S. 2767*, Report No. 93-601, United States Senate, December 6, 1973, p. 18.

5. *Rail Revitalization and Regulatory Reform Act of 1975, Report of the Committee on Interstate and Foreign Commerce, Together with Supplemental and Dissenting Views on H.R. 10979*, Report No. 94-725, U.S. House of Representatives, December 12, 1975, p. 85.

6. FRA Offices of Railroad Development, *The Northeast Corridor Transportation Plan - New York City to Boston*, July 1994.

CHAPTER 2
DEVELOPMENT AND DESCRIPTION OF ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the development of alternatives considered in this combined Final Environmental Impact Statement and Final Environmental Impact Report including those that were considered and eliminated from detailed consideration as well as those which are evaluated in detail in Chapter 4. The project under consideration in this document is the proposal by Amtrak to extend electric traction (electrification) on the Northeast Corridor main line from New Haven, CT, to Boston, MA. This proposed project is but one of a large number of component projects that comprise the Northeast Corridor Improvement Project.

NECIP was mandated by Congress in Title VII of the Railroad Revitalization and Regulatory Reform Act of 1976 as a program to upgrade intercity rail passenger service between Washington, DC, through New York City, NY, to Boston, MA. Substantial planning for improved intercity rail passenger service had been undertaken during the decade prior to the passage of the 4R Act. Based on these earlier studies, the Federal Railroad Administration undertook identification of a program to meet the goals for NECIP established by Congress.

A major part of FRA's decision making process was preparation of a PEIS. The purpose of a PEIS is to identify the various alternative approaches for broad Federal actions such as NECIP that can meet overall program goals, and to identify the environmental impacts associated with these alternatives. The NECIP PEIS was issued in June 1978, and was used to support the Federal Railroad Administrator's decision in selecting the preferred program for NECIP. This preferred program includes extension of the electric traction between New Haven and Boston which is the subject of this FEIS/R (see Section 1.2).

FRA and Amtrak have been implementing NECIP since 1978. To date, approximately $3 billion has been spent to improve the infrastructure of the NEC main line as part of NECIP, including approximately $1.1 billion on the shore line between Boston and New Haven.

Since 1991, Congress has appropriated approximately $292.8 million specifically earmarked for the electrification of the NEC between Boston and New Haven. FRA's flexibility in the use of these funds is severely constrained. As an example, FRA cannot use funds earmarked for electrification to develop non-electric locomotives or trainsets. Either FRA can make the funds available to Amtrak to undertake the electrification project, or FRA must request that Congress reprogram the funds for some other purpose. In considering such a reprogramming request, Congress could choose to direct FRA to proceed with the electrification project, permit the funds to be used for some other alternative to improve rail passenger service between Boston and New York City, or even redirect the funds to some purpose not affiliated with NECIP, such as earthquake relief.

The alternatives facing FRA in the context of this project and this FEIS/R are the "Proposed Action" which is the extension of electrification between Boston and New Haven, or the "No-Build Alternative," under which the electrification project would not proceed. As stated above, if the electrification project does not proceed, it is uncertain what actions, if any, would be taken to improve rail passenger service in the Boston to New York City portion of the NEC. The No-Build Alternative, therefore, addresses a number of different scenarios of what might happen in the absence of electrification. This FEIS/R also reviews and updates the program alternatives considered in the PEIS as they relate to the proposed electrification project.

After evaluation of the costs, benefits, and environmental impacts of the various alternatives, FRA has selected as its preferred alternative Amtrak's proposed project, modified by the mitigation and other requirements outlined in Chapter 5.

2.2 SUMMARY OF THE 1978 PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

The PEIS evaluated a wide range of potential alternatives to electrification as well as alternate forms of electrification. These alternatives varied by mode, technology, traction power system, route, and level of service. Whether an alternative offered a significant improvement over existing travel time along the NEC and, if so, whether the technology required would be available in the time frame necessary for project operation, were critical criteria early in the screening process. Alternatives were raised and subsequently dropped from further analysis in the PEIS due to economic or environmental considerations. The following sections describe the four categories of alternatives evaluated in the PEIS.

2.2.1 Non-Rail Alternatives

PEIS. Non-rail alternatives analyzed included:

- A no-action alternative that would entail no public investment in the NEC beyond routine maintenance.
- Investment in other modes of transport only, such as expanded highway, intercity bus, and airport capacity.
- Continued investment in all transportation modes at current (1978) levels.

The do-nothing alternative was not considered a prudent or feasible alternative from an economic standpoint because disinvestment in the NEC would result in deterioration of the ROW and thus threaten existing passenger, freight, and commuter rail operations. This disruption of the corridor could, in turn, adversely impact the regional economy. Investment in modes other than rail was viewed as similarly undesirable because of the social, environmental, and economic costs associated with the land acquisition that would be required for new airports or highway lanes. Finally, investment in all modes at 1978 levels would result in socioeconomic and other environmental impacts similar to those associated with investment in non-rail alternatives.

1994 Update. In the 16 years since the decision in 1978 to choose a rail investment alternative, circumstances have not changed sufficiently to call into question the need for additional investment in rail improvements to the NEC. The adverse impacts of implementing rail improvements have not proven to be unexpectedly severe. Furthermore, no other form of transportation infrastructure investment has demonstrated itself to be clearly superior from an environmental perspective to investment in NECIP or capable of replacing intercity rail passenger transportation in the NEC without significant new investment in expanded facilities.

NECIP has become an even more essential part of the NEC's transportation infrastructure over the last 16 years. When the major NECIP improvements between Washington, DC, and New York City were completed in 1983, Amtrak's share of the combined total of air and rail travel between Washington and New York City was 20 percent. In 1993 it was 45 percent. In the intermediate markets in this corridor (e.g., Washington to Philadelphia, or Baltimore to New York City), Amtrak carries in excess of 70 percent of the combined total air and rail trips. Amtrak's present share of the combined total air and rail trips between New York City and Boston is 20 percent.

At the same time that dependence on intercity rail passenger service has increased, air passenger service, intercity rail's primary competition in the intercity transportation market, has become beset by capacity problems. The Federal Aviation Administration (FAA) develops forecasts of delay at major airports using 20,000 hours of airline flight delays annually to define "delay problem." In its most recent report on airport capacity plans, 23 airports nationwide were identified as having delay problems in 1990. Of these, six are in the NEC (Washington National; Philadelphia; Newark, LaGuardia, and Kennedy airports serving New York City; and Boston's Logan Airport). FAA projects that by 2002, assuming no capacity increases, there will be 33 airports with delay problems including the six NEC airports presently experiencing such problems, plus Washington's Dulles and Baltimore-Washington

International. Even with envisioned improvements to airport capacity, large metropolitan airports, principally in the Northeast and in California, will continue to experience significant delays.[1]

Such significant delays may require aggressive measures to address the capacity problems, such as developing new airports or civilian use of existing or former military air bases. Such measures generate their own significant environmental problems. Indeed, one of the primary reasons behind CONEG's strong support for improved rail service between Boston and New York City is to eliminate or delay the need for constructing a second Boston airport.[2] Investment in intercity rail passenger service has the potential to attract significant numbers of air passengers to rail transportation, helping to address some of these capacity problems at less environmental cost. As an example, at 200 miles, the current Amtrak *Metroliner* consumes only 25 percent of the energy on a seat-mile basis as a Boeing 737. The absence of intercity rail investments could lead to a decline in the use of intercity rail passenger service in the NEC and exacerbate aviation's capacity problems, thereby making solutions to these problems more difficult to achieve.

Similarly, highway traffic congestion in metropolitan areas has also increased since 1978 and the congestion trend line is worsening. The percent of peak hour travel that occurs under congested conditions has almost doubled, from 41 percent in 1975 to 70 percent in 1992. The percentage of urban interstate mileage that is considered congested has doubled in the same time frame, despite a tripling of current-dollar annual outlays from the Federal Highway Trust Fund.[3] FHWA also predicts that it will cost $34 billion per year in capital investments by all levels of government just to preserve the integrity of the urban highway system and to keep congestion from worsening. In 1991, only $15 billion was spent for this purpose.[4]

In the final analysis, however, the debate on whether continued funding for rail improvements to the NEC main line is appropriate took place in Congress. From 1985 until 1993, each successive administration requested that no further funds be made available for NECIP. During that time, Congress appropriated $705 million for NECIP.

2.2.2 New Technologies

PEIS. Several new technologies were raised, evaluated, and subsequently eliminated from further consideration in the PEIS due to cost and environmental considerations. These technologies included advanced high-speed rail (AHSR) at 200 mph, similar in technology to the Japanese bullet trains; underground tube vehicles; tracked air cushion vehicles (TACV); and magnetic levitation vehicles (Maglev). The underground tube system would have required an enormous public investment due to the exorbitant costs of acquiring and constructing a 457-mile-long underground tunnel. The AHSR, TACV, and Maglev technologies would have all required a new ROW with minimum route curvature. Assembly of a new ROW through the heavily developed and densely populated region of the NEC would have involved excessive cost, as well as undesirable socioeconomic and environmental impacts, such as dislocation of residences and businesses and disruption of sensitive ecosystems.

1994 Update. There have been no significant changes in the state of technology development or environmental conditions since publication of the PEIS that show that any new technology offers a clearly cost effective and environmentally superior alternative to the program decisions made in 1978.

The primary problem with development of AHSR identified in 1978 was the need to assemble a new ROW and develop a largely new infrastructure in the Washington-New York City-Boston corridor with their attendant costs, both financial and environmental. Such a system would require acquisition of up to 450 miles of new ROW in one of the most developed sections of the country. Development has proceeded unabated in the 16 years since the PEIS and, if anything, it would be more difficult to assemble a new ROW now than in 1978. FRA recently estimated that the initial capital cost of developing a system similar to the French-designed *TGV* high-speed train in the NEC would be $15.6 billion (1993 dollars).[5] High-speed rail projects in California, Florida, and Texas in the last several years have shown that such projects cannot be developed without substantial public financial support. The sum required to develop an AHSR system in the NEC far exceeds the funds authorized or likely to be appropriated for NECIP.

Although there have been some advancements in tunneling technology, these have not been sufficient to change the conclusion that the limitations on the state-of-the-art tunneling technique make it prohibitively expensive to consider as an alternative for a 450-mile-long system. Currently, underground urban transit costs approach $100 million per mile.

TACV proved impractical and, other than demonstration of a prototype developed by FRA, this form of rail transportation has never been implemented.

Although there has been advancement of Maglev technology in the 16 years since the PEIS, this technology has yet to enter commercial service. At best, it can be viewed as an option for implementation in the long term. The potential for Maglev was the subject of a detailed analysis by an interagency team led by FRA called the National Maglev Initiative (NMI). The NMI concluded that U.S. industry could develop an advanced Maglev system superior to systems under development in Germany and Japan. Such a system, however, was unlikely to be developed without significant Federal financial investment (on the order of $800 million for the first prototype). This prototype would be available for testing in 2001 at the earliest and would not be available for revenue service until mid decade, assuming a 1994 program start. The NMI estimated the cost of a U.S.-designed Maglev system in the NEC at $21.2 billion (1993 dollars).[6]

The NMI report recommended proceeding with Phase I of the prototype development. The current administration requested funding for this program as part of its fiscal 1994 budget request; however, no funds were appropriated for this program. The administration did not request any funds for the program for fiscal 1995 and it is unclear when, if ever, this program will begin.

Germany has developed a Maglev system designated *Transrapid*. Although its capabilities and safety aspects have been extensively analyzed by Germany and FRA, to date it has not been developed for commercial service.[7] Recent press reports indicate that the German government has made a tentative decision to develop a *Transrapid* Maglev system between Hamburg and Berlin, a distance of 185 miles. If undertaken as planned, this system will be ready for commercial service in 2005 and will cost approximately $5.2 billion to develop. The Japanese have also developed high-speed Maglev systems, but are somewhat behind Germany in terms of a decision on commercial application of this technology. Finally, even if a Maglev system were commercially feasible, the adverse impacts associated with acquiring and developing a dedicated ROW that were identified in the PEIS would remain.

2.2.3 Traction Power Alternatives

Five alternative traction power systems were assessed in the PEIS. Of the five systems, four were subsequently eliminated from further consideration:

- Retention of the existing dual traction system (diesel-electric north of New Haven, electrification south of New Haven)
- Conversion to an all gas turbine operation from Washington to Boston
- Conversion to an all diesel-electric operation (continuation of the Boston to New Haven system south to Washington)
- Conversion to a direct current (DC) power system (either third rail or catenary)
- Full electrification of the NEC with either an 11 kV-25 Hz or a 25 kV-60 Hz system

Retention of Existing Dual Traction System.
PEIS: While retention of the existing dual traction system between Boston and Washington would have required no major capital investment, it had several operational and environmental flaws noted in the PEIS. Specifically, the existing system offered no improvement in travel time savings relative to other alternatives due to: (1) lower

achievable operating speeds; (2) the need to switch from diesel to electric locomotives in New Haven; and (3) poor acceleration and deceleration capabilities. Furthermore, unlike several other proposed power systems, it offered no environmental benefits. Diesel pollutant emissions and noise were projected to rise as intercity service expanded to accommodate projected growth in passenger demand.

1994 Update: The discussion of this alternative is included in this FEIS/R as part of the No-Build Alternative described in Section 2.4.1. That section identifies a slightly updated version of the existing diesel-electric operation with an equipment change in New Haven. Section 2.4.1 also analyses two scenarios involving advanced high-speed non-electric locomotives/trainsets operating between Boston and New York City.

Conversion to All Gas Turbine Operation/Conversion to All Diesel-Electric Operation.
PEIS: Abandonment of the existing electrification south of New Haven in favor of a gas turbine operation (in which locomotives would be powered by a gas turbine engine) or a diesel-electric operation (in which diesel-electric locomotives would be exclusively used) were dropped from further analysis in 1978 because of cost, environmental, and operational shortcomings. In addition, conversion to gas turbine locomotives would have required: (1) a large capital outlay for rolling stock; (2) construction of major new fuel depots between Boston and Washington; (3) major retraining of Amtrak maintenance personnel; and (4) significantly increased diesel fuel consumption. Accordingly, this alternative was not subject to detailed analysis in the PEIS.

Extension of the diesel-electric locomotive system from New Haven to the NEC terminus in Washington would have required abandonment of the existing electrification south of New Haven. The PEIS noted that while this alternative would have avoided the capital expense of electrification north of New Haven, and maintenance of the existing catenary system south of New Haven, it would have had adverse environmental consequences, as well as capital costs attendant with dismantling the existing catenary system. Noise and air quality conditions south of New Haven would have deteriorated because of the additional emissions that would have resulted from a full diesel locomotive operation along the entire NEC. In addition, the acceleration capabilities of this equipment were inferior to electric locomotives and their use would have degraded rather than improved operating conditions along the corridor. Therefore, this alternative was also not the subject of extensive analysis in the PEIS.

1994 Update: Circumstances have not changed sufficiently in the 16 years since the PEIS to demonstrate that there is a clearly superior means to meet the goals of NECIP that would include abandonment of the existing electrified system south of New Haven. Since 1978, NECIP improvements to the electric traction system between Washington and New York City have totaled $139.2 million, exclusive of equipment. The present service meets the original Congressionally mandated Washington to New York City trip time goals, and new equipment on order will help Amtrak to meet the updated trip time goals of 2.5 hours. In addition, Metro North Commuter Railroad has undertaken a major upgrade of its electric traction system between New York City and New Haven.

Since 1978 there have been modest improvements to the capabilities of diesel-electric locomotives used in intercity passenger rail service in the U.S. with the introduction of the AMD-103 in 1993. No gas turbine locomotives or trainsets have been manufactured worldwide since 1981. As a consequence, the current proven capabilities of these forms of power remain much as they were in 1978. (Proposals to enhance the capabilities of non-electric locomotives and trainsets are discussed in Section 2.4.1.)

There are no existing forms of non-electrified rail operation that can meet the current and future capabilities of NECIP electrified operation. Amtrak, which is the owner of the electrified rail line between Washington and New York City, is committed to maintaining and upgrading its current electric operation and would oppose efforts to eliminate electric traction.

A major advantage of electric operation over currently available non-electric locomotives is lower trip time. Lengthening trip times by conversion to available non-electric forms of power would be inconsistent with the goals of NECIP and would result in a loss of ridership, putting more travelers on less efficient and more congested air and highway systems. This is particularly true of the conventional train service, which accounts for almost 80 percent of the ridership in the Washington to New York City corridor (8 million passengers per year). While short

non-electric trains may approach the trip times of express electric trains, their comparatively low power (typically less than 3,000 horsepower) makes them unsuitable for the conventional service. Conventional trains between Washington and New York City typically have 18 cars and have electric locomotives which total between 12,000 and 18,000 horsepower. Quick acceleration is even more important for these trains than for the express service because of their frequent stops. Converting such trains to non-electric locomotives, most likely diesel-electric, would result in a significant degradation of trip times.

There would be an increase in the net fossil fuel consumption and air pollutant emissions if the existing electric operation were replaced by the non-electric rail equipment presently in operation or being manufactured. (See discussion of the AMD-103 and FF-125 alternative air pollutant emissions in Section 4.10.) Almost as important as the increase in air pollutant emissions, the location of these air pollutant emissions would change. The existing electric operation generates its emissions only at fossil fuel power plants which account for 59.2 percent of the electric power consumed in the Washington to New Haven area. (The remainder is generated at hydroelectric or nuclear power plants which have little or no air pollutant emissions.) In addition, major power plants are often located outside the most densely populated and polluted urban cores. Use of non-electric locomotives would generate air pollutant emissions over the entire length of the rail line including the urban cores with the greatest air pollution problems. Given the limits of existing non-electric technologies in the air pollution area, it is unlikely that the states would approve conversion from electric to non-electric operation under the conformity provisions of the Clean Air Act.

Existing non-electric rail equipment emits a greater amount of noise than the existing Amtrak electric equipment, which in turn is noisier than the electric rail equipment currently in operation overseas and the new U.S.- produced equipment likely to be acquired by Amtrak in the near future for NEC service. (See discussion of comparative noise emissions in Section 4.4.) As a consequence, abandonment of electric operation in favor of non-electric operation would generate more noise along the NEC.

In addition to impacts on intercity service, abandonment of electric traction by Amtrak would have adverse impacts on commuter operations on the NEC. The NEC electric traction system operated and maintained by Amtrak has become an integral part of the commuter operations into Washington and Baltimore by Maryland Department of Transportation/Maryland Rail Corporation (MARC), into Philadelphia by Southeastern Pennsylvania Transportation Authority (SEPTA), and into New York City by NJ Transit and MetroNorth Railroad. The costs of operation and maintenance of the electric traction system are borne by Amtrak, with the commuter agencies paying the incremental cost of their operations. If Amtrak were to abandon its electric traction system, the cost of operation of commuter rail service would increase as the commuter agencies took over primary responsibility for operation and maintenance. If passed on to passengers, this would reduce mass transit ridership with likely negative impacts from increased highway congestion and automobile-based air pollution emissions.

Replacement of electric commuter trains by existing non-electric rail equipment (total abandonment of the NEC electric traction system) would have similar adverse impacts on commuter service and ridership. The non-electric trains would add more mobile source air pollutants. More importantly, they would have inferior performance. This would, in turn, increase trip times and decrease capacity, making this mass transportation alternative less desirable.

The review of these alternatives does not indicate a significant environmental benefit sufficient to justify a reconsideration of the NECIP program decision to maintain the existing NEC electric traction system. Therefore, this issue does not receive additional analysis in this FEIS/R.

Conversion to Direct Current Power System.
PEIS: Conversion of the existing dual traction system to direct current (DC) power using third rail or catenary would have required a substantially greater number of substations along the entire NEC than Amtrak's proposal, and would have required conversion of alternating current (AC) to DC power, adding equipment and weight to the train, thereby decreasing rather than increasing operating speeds along the corridor. The third-rail DC alternative would have required the placement of live lethal voltages along the entire 457-mile ROW, and therefore

would have presented an unacceptable public safety hazard even with additional fencing. For these reasons, the alternative was dropped from further consideration in the PEIS.

1994 Update: The problems identified in 1978 with implementing this alternative remain today and it is not discussed further in the FEIS/R.

Full Electrification of the NEC.
PEIS: The final power traction alternative, electrification of the entire NEC at 25 kV-60 Hz, was selected as part of the preferred program because of the five alternatives, it offered the greatest operational and environmental benefits at the least cost. The principal operational benefits of electrification that were identified included superior acceleration and deceleration capabilities, higher achievable operating speeds, and the elimination of the locomotive change at New Haven. Due to these operational benefits, travel time along the corridor between Boston and New York City -- the primary performance criterion -- was projected to decrease significantly. In addition, air quality and noise improvements were projected from reduced air traffic along the NEC as well as the replacement of diesel locomotives with electric locomotives.

1994 Update: This alternative is addressed in detail in this FEIS/R as the Proposed Action.

2.2.4 Route Alternatives

2.2.4(a) Two Alternatives in the PEIS

PEIS. The legislation authorizing NECIP provided that the main line of the Northeast Corridor, which includes the Shore Line Route, be upgraded to meet the goals of the program. The PEIS, however, investigated two route alternatives for proposed high-speed rail service between New Haven and Boston. One was the Shore Line Route, which runs adjacent to the Rhode Island and Connecticut coasts; the other was the Inland Route. The Inland Route consists of the Amtrak-owned line from New Haven through Hartford, CT, to Springfield, MA (62 miles), the Conrail-owned line between Springfield and Framingham, MA (77 miles), and the MBTA-owned line between Framingham and Boston's South Station (22 miles) (see Figure 2.2-1). The PEIS reached the following conclusions regarding these routes:

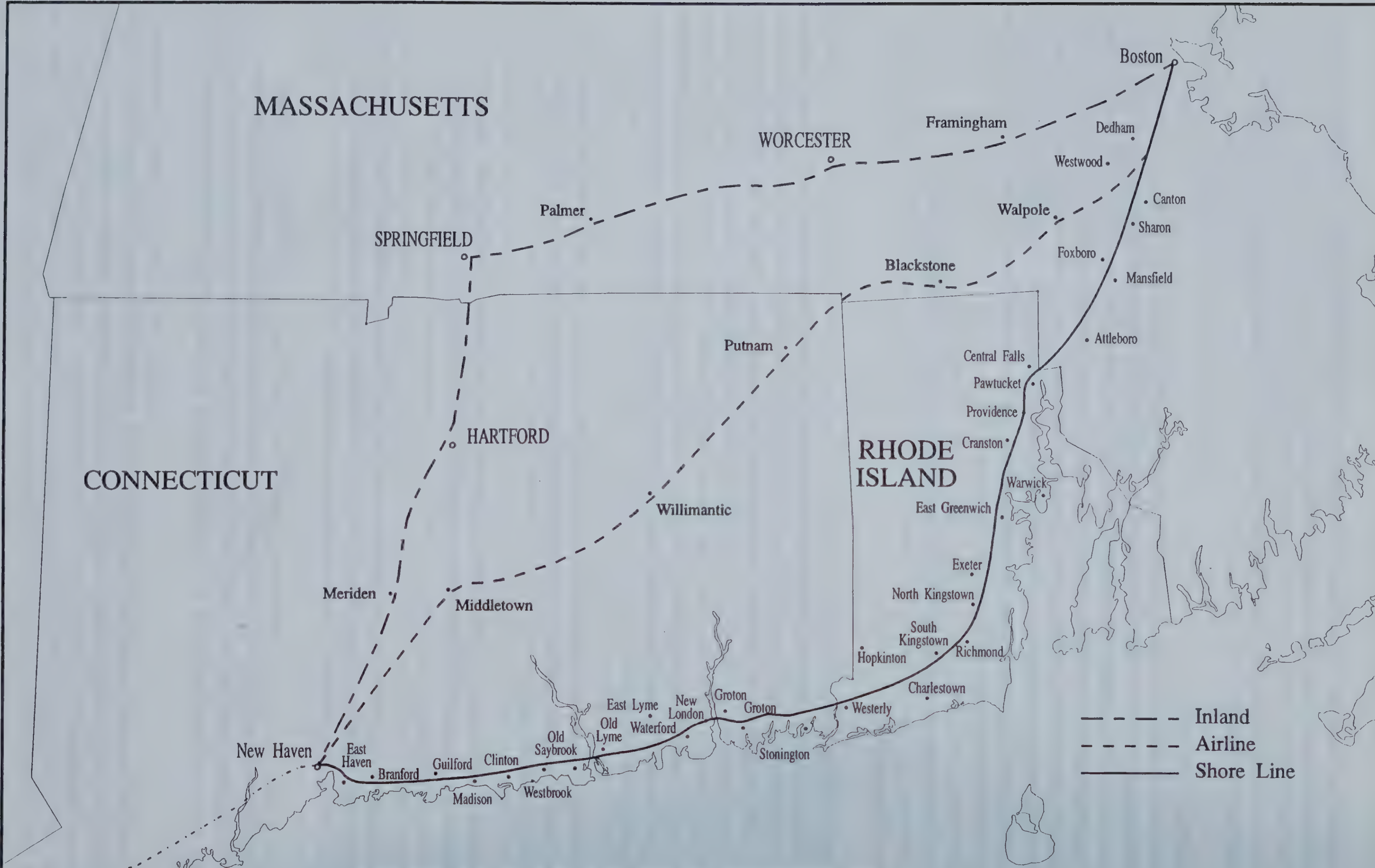
- "Overall system patronage and revenues would probably be increased by adoption of the Inland Route alternative, assuming that system performance equivalent to that proposed for the Shore Line could be achieved.

- "Given the disadvantages of the Inland Route in terms of present operating and physical characteristics, conflicting freight use, and ownership, the cost of implementing the Inland Route alternative is expected to exceed the cost of necessary improvements to the Shore Line Route.

- "Commitment of only the available capital resources to the Inland Route alternative would result in system performance substantially below the level mandated by law (and that judged necessary to attain the projected levels of system patronage and revenues).

- "Environmental impacts seem somewhat greater on the Inland Route but the difference would not be the controlling factor so long as the proposed improvements remain in the existing right-of-way. (Since there is a need for a large gain in time on the Inland Route, a likelihood exists that major curve realignments would be necessary, thereby increasing the potential for adverse impacts.)

- "To meet the required system goals of improved trip times with available resources by the required date, the proposed routing via the Shore Line between New Haven and Boston is the preferred alternative."[8]



INLAND, AIRLINE, AND SHORE LINE ROUTES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 2.2-1

1994 Update. In 1978 the cost, environmental impacts, and time associated with achieving NECIP program goals were found to be greater with the Inland Route than with the Shore Line Route. The relative difference between the Inland Route and the Shore Line Route in meeting these goals in 1994 has increased, largely as of the result the $1.1 billion already invested by the Federal government in NECIP-related improvements to the Shore Line and its related facilities.

The PEIS compared the metropolitan area populations of the communities located along the Shore Line Route and Inland Route. Table 2.2-1 updates Table 2-7 from the PEIS.

TABLE 2.2-1 Metropolitan Area Population: Shore Line vs. Inland Route (1975 - 1990)

SHORE LINE ROUTE	POPULATION		
	1975	1990	% INCREASE (DECREASE), 1975-1990
New London-Norwich	240,000	266,819	11
Providence-Warwick-Pawtucket	854,000	1,141,510	34
Total metropolitan population between New Haven and Boston	1,094,000	1,408,329	29
INLAND ROUTE			
Hartford-New Britain-Bristol	1,058,700	1,085,837	3
Springfield-Chicopee-Holyoke	589,700	529,519	(10)
Worcester-Fitchburg-Leominster	648,400	436,905	(33)
Total metropolitan population between New Haven and Boston	2,296,800	2,052,261	(11)

Source: U.S. Census Bureau, 1978, 1994

The PEIS concluded that because the rail service on the Inland Route would serve a larger population base it could be assumed that with an equivalent quality of service, this route would generate a higher patronage and revenue. This general assumption would still hold.

Use of the Inland Route would bypass the stations on the Shore Line including three that would be served by the proposed high-speed service: Providence and Route 128, which are served by all trains, and New London, which would be served by at least three express trains per day. It is assumed that a new suburban Boston station would be built. It is also assumed that Amtrak would continue to operate its current local service over the Shore Line in a manner analogous to the current Inland Route service which currently consists of four trains per day between Boston and New Haven. The enhanced service to Worcester, Springfield, and Hartford would offer new opportunities for developing intercity and commuter markets.

The increased ridership projected in the PEIS, however, was viewed as small in comparison with projections of systemwide ridership growth due to the higher population growth rates projected for the Shore Line. The population along the Shore Line has indeed grown more rapidly (see Table 2.2-1), and this conclusion appears to remain equally valid. The PEIS also concluded that any relative advantage of the Inland Route over the Shore Line Route would be slow to develop.

Table 2.2-2 updates Table 2-5 of the PEIS and compares some of the important physical characteristics of the Shore Line Route and Inland Route. While the Inland Route has more curves, the Shore Line Route has a greater mileage over severe (over 4-degree) curves. The Shore Line is superior in terms of grades, having only 2 miles with grades above 0.75 percent while the Inland Route has 12.6 miles of grades above 0.75 percent and 3.7 miles greater than 1 percent. The Shore Line also has 53 fewer grade crossings.

TABLE 2.2-2 Physical Characteristics of Alternate Routes

CHARACTERISTIC	SHORE LINE ROUTE		INLAND ROUTE	
	PEIS	1994	PEIS	1994
Route Mileage	156.9 miles		161.5 miles	
Maximum Train Speeds (passenger trains)				
100+	0	8.0	0	0
90-100	0	34.9	0	0
80-90	0	22.6	0	0
70-80	128.1	63.9	0	51.4
Below 70	28.8	27.2	161.5	110.1
Number of Crossings at Grade				
Public	23	11	38	41
Private	26	3	39	26
Total	49	14	77	67
Degree of Curves	(number)	(miles)	(number)	(miles)
0-1	N/A	114.4	N/A	113.8
1-2	65	21.8	62	23.6
2-3	41	9.9	49	13.6
3-4	23	5.9	24	7.6
4-5	10	2.6	8	1.7
over 5	9	2.3	6	1.2
Grades (in miles)				
0.75% - 1.0%	2.0		12.6	
over 1.0%	0		3.7	
Number of Bridges				
Undergrade	204		199	
Overhead	191		201	
Total	395		400	

N/A: Not applicable

Source: Federal Railroad Administration, DMJM/Harris, 1978, 1994

Also shown in this table is the substantial improvement in speeds on the Shore Line Route which reflects the results of some of NECIP investment in this route. Part of this improved speed comes from the 171 track miles of concrete crossties inserted as part of NECIP, which are an important part of future high-speed service.

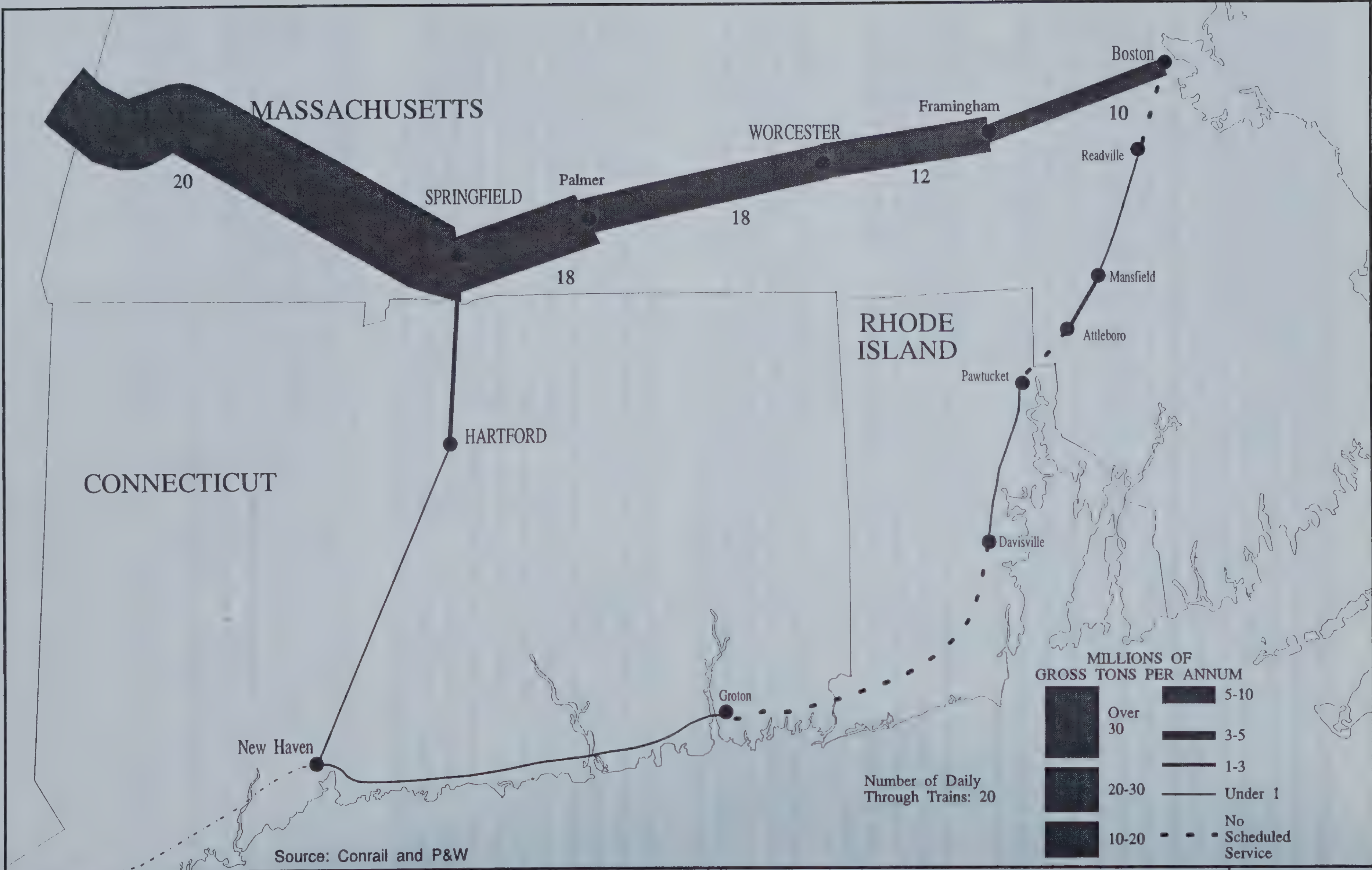
Figure 2.2-2 updates Figure 2-4 of the PEIS and presents the volume of freight traffic and freight train frequency as well as ownership of the major segments of the Shore Line and Inland routes. One of the major issues raised in comments on the DEIS/R for the proposed electrification project in 1994 is concern over the impact of high-speed rail service on freight service on the Shore Line in Connecticut and Rhode Island. While the Shore Line is used to provide direct freight service to a number of businesses, the Inland Route between Springfield and Boston is the major freight rail link between Boston and the rest of the country. It is part of Conrail's main line system. In addition, the Guilford Railroad system (Boston and Maine/Springfield Terminal) has been diverting through traffic from its Boston to Albany (Mechanicville) route to this route as well. As can be seen in Figure 2.2-2, the greatest amount of freight traffic on any segment of the Shore Line Route (Attleboro to Mansfield) is about 10 percent of the volume of freight traffic on the Springfield to Worcester segment of the Inland Route. In addition, significantly greater volumes of hazardous materials move over the Inland Route than move over the Shore Line. In fact, the volume of hazardous materials shipments on the Springfield to Worcester segment is 40 percent larger than the total freight traffic on the Attleboro to Mansfield segment of the Shore Line, which carries the largest volume of hazardous materials on this route.

In addition to the Conrail and Amtrak operations over this corridor, 33 MBTA commuter trains daily operate between Boston and Framingham on this rail line. MBTA proposes to extend this service 23 miles west to Worcester. This proposal would include construction of a second track between Westborough and Worcester, improving signals for 70-mph service, and the addition of stations at Ashland, Southborough, Westborough, Grafton, and Milbury.[9]

Accommodating high-speed passenger service with a densely utilized freight operation would be a significant challenge. Attempts to develop high-speed service on existing infrastructure to date have focused on light-density freight lines to avoid the capacity and conflict problems. There are also the safety issues associated with having many trains of different speeds operating on the same track and the effect on passenger train safety of possible shifting of loads or derailments associated with freight service.

The Inland Route, with heavy volumes of freight traffic and growing commuter traffic and with substantial stretches of single track rail line, does not have the capacity to accommodate increased intercity passenger trains without major upgrades. In addition, Conrail has taken a strong position against joint use of tracks by freight and high-speed passenger service. Conrail's position is that any rail passenger service with speeds in excess of 90 mph that wishes to use tracks that Conrail owns must operate on a separate track, physically removed from any freight service conflict. In addition, Conrail will permit a maximum superelevation of 4 inches with an increase to a 3-inch underbalance speed.[10] The Shore Line Route will have 6 inches superelevation (the maximum permitted under FRA's safety regulations) with 8 inches underbalance. The net effect of this difference is to permit passenger trains to traverse a given radius curve on the Shore Line Route at a higher speed than would be permitted on the Inland Route. This difference would likely require that more curves be straightened on the Inland Route to achieve trip time goals, resulting in more frequent divergence from the existing rail ROW.

There has been no detailed engineering study to develop the cost of an upgrade of the Inland Route to accommodate high-speed service proposed by Amtrak. The Transportation Research Board (TRB), in a 1991 report, estimated the cost to upgrade a hypothetical corridor to accommodate 150-mph service with some bypass segments for freight service at $12.7 million per mile and the cost to construct a new dedicated line at $17.5 million per mile in 1991 dollars. (Inflated to 1993 dollars, these estimated costs would be $13.5 million and $18.6 million respectively.)[11] Using the TRB hypothetical estimates, upgrade of the Inland Route would cost between $2.2 billion and $3.0 billion (1993 dollars), excluding station work.



FREIGHT DENSITY: INLAND AND SHORE LINE ROUTES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 2.2-2

Such estimates do not reflect unique local conditions that can significantly increase cost. As an example, the hypothetical assumptions on which these estimates are based assumed two cities 200 miles apart with largely rural land in between. In this particular corridor there are five major cities (counting Boston and New Haven) in 161 miles. As a consequence, the corridor has more urban and suburban characteristics than the hypothetical corridor, which would make construction more costly and difficult. To show how estimates based on specific local conditions can differ from estimates based on hypothetical conditions, the same engineering firm that prepared the TRB hypothetical estimate also prepared in 1991 an estimate of the cost of realigning approximately 50 miles of the Shore Line Route between Old Saybrook, CT, and East Greenwich, RI. The estimate prepared for that report averaged $30 million per mile (1991 dollars, or $31.8 million in 1993 dollars).[12] Using this average cost, the Inland Route upgrade would cost $5.1 billion (1993 dollars). Amtrak estimates the cost to upgrade the Inland Route to provide trip times equivalent to those proposed for the Shore Line at $4 billion.

The estimates for improving the Shore Line between New Haven and Boston are much more detailed and site-specific, and are presented in FRA's Northeast Corridor Transportation Plan.[13] These estimates show that the cost to provide high-speed service over the Shore Line, including provisions for capacity of freight and commuter trains, replacement of the Niantic and Groton moveable bridges, and the remaining station work would cost $1.57 billion.

The PEIS concluded that the environmental impacts would be somewhat greater on the Inland Route. The difference in relative environmental impact between developing the Inland Route and Shore Line Route are now significantly greater than when the PEIS was prepared. Most of the environmentally sensitive construction activities on the Shore Line have already taken place. These include: undercutting and ballast renewal; crosstie replacement; replacement of the moveable bridges at Shaw's Cove and Mystic; ROW improvements including a hurricane barrier at Shaw's Cove; elimination of 35 grade crossings; renewal of numerous undergrade bridges; construction of the signal system; realignment of tracks and replacement of the station at Providence, RI; and restoration of the station at New London, CT. At the same time, the amount of new construction required to upgrade the Inland Route is greater than envisioned in the PEIS. Construction of track improvements, including significant segments of new double track alignment, would require extensive excavation and grading and the construction of bridges over and in waterways and wetlands which will result in impacts on vegetation, wildlife, soil erosion, water quality, and other construction-related impacts.

Impacts from operation of the rail facility would primarily represent a transferral of these impacts from the Shore Line to the Inland Route. Because of the greater population along the Inland Route, the PEIS concluded that these impacts, such as noise, would impact more persons along that route than along the Shore Line. This relationship would be the same. The Inland Route would eliminate the impacts of high-speed train service on marine traffic using the five moveable bridges in Connecticut that are part of the Shore Line Route (see Section 4.2) and on the scenic values of the Connecticut coast line (see Section 4.11).

The PEIS concluded that it would take longer to achieve high-speed service on the Inland Route than the Shore Line Route. This remains true today. Amtrak's current plans call for initiation of 3-hour Boston to New York City service in 1999. If the Inland Route was developed for high-speed service, 3-hour service would most likely not occur before late 2004 at the earliest. This would result in a delay in realizing the substantial environmental benefits that would result from high-speed rail service between Boston and New York City.

Finally, the PEIS concluded that: "To meet the required system goals of improved trip times with available resources by the required date, the proposed routing via the Shore Line between New Haven and Boston is the preferred alternative." That conclusion remains valid. Development of the Inland Route to provide the trip time equivalent of the Shore Line Route would take longer, cost more, and have greater environmental impact than completing NECIP on the Shore Line.

The PEIS also considered two route alternatives to upgrading parts of the Shore Line. The first was a 8.9-mile alternative alignment between the Providence station and the East Boston switch using what is referred to as the tunnel route. This was dismissed because of the lack of Amtrak ownership, high improvement cost, longer

implementation time, and adverse impacts associated with construction. The existing Shore Line Route in this area has been significantly upgraded since 1978 as part of NECIP. Therefore, the relative differences between use of the Shore Line in this area and the tunnel route have grown.

The second Shore Line realignment was to use the Dorchester Branch in lieu of the main line. The PEIS concluded not to proceed with this alternative for three major reasons: (1) this route would not serve Back Bay Station, (2) the high number of overhead bridges with low clearances would make electrification difficult, and (3) there were concerns over the ability of the Dorchester Branch to have sufficient capacity to accommodate both intercity and commuter traffic. As with the alternative segment in the Providence area, the relative differences between this alternative and the upgrade of the Shore Line have grown in the last 16 years as a result of NECIP investment.

2.2.4(b) Post-PEIS

I-95 Realignment. In 1991, prior to scoping for the DEIS/R, a separate study conducted for Amtrak assessed the feasibility of a new high-speed rail alignment along the Interstate-95 corridor between Old Saybrook, CT, and East Greenwich, RI.

This route realignment would permit the high-speed service to avoid a 53-mile-long segment of the existing Shore Line Route that contains many curves, the five moveable bridges, the highway-rail grade crossings in Connecticut and Rhode Island, as well as the train stations at New London, Mystic, and Westerly. (The study considered a consolidated new station for these cities.) It was assumed that the Shore Line would continue in operation for freight, commuter, and a limited number of Amtrak conventional trains using diesel power.

This route realignment would require approximately 60 new bridges over roads and highways, and 45 bridges or culverts over streams, including major bridges over the Connecticut, Mystic, Thames, and Pawcatuck Rivers. Construction of this realignment would impact vegetation, wildlife, soil erosion, and water quality, and have other construction-related impacts. If it is assumed that a minimum width of 50 feet would be disturbed for roadbed construction, at least 300 acres would be disturbed. Several wetlands areas would be traversed, requiring destruction of about 60 acres of wetlands and lesser impact on or acquisition of an additional 190 acres. In addition, it would displace about 10 businesses, including two marinas on the Connecticut River, 86 residences, and three historic structures.

On the other hand, this realignment would avoid impacts by high-speed rail service on marine traffic through the five moveable bridges, transfer the visual impact of the catenary from 50 miles of the coastline to inland sites, and avoid intrusions into the historic districts of New London, Mystic, Stonington, and Pawcatuck.

The study concluded that this alternate alignment could be operational in approximately 8 to 14 years and would cost between $1.55 and $1.95 billion ($1.64 and $2.07 billion in 1993 dollars), in addition to the estimated cost of upgrading the existing NEC ROW between New Haven and Old Saybrook, and between East Greenwich and Boston. It would eliminate the need to undertake approximately $345 million (1993 dollars) in improvements to the Shore Line; therefore, this alternative would require an additional $1.3 to $1.7 billion (1993 dollars) investment over the projected cost of improving the existing main line north of New Haven and would result in travel time savings of approximately 20 minutes.

Due to the relatively high incremental cost ($1.3 to $1.7 billion), the high environmental costs, the uncertainty as to when this realignment would be complete, and the limited capital resources that Amtrak believes are available in the foreseeable future, Amtrak chose not to pursue development of this plan. In light of the potential environmental impacts, the delay associated with implementation, and the significant incremental cost, FRA does not believe that the benefits to be derived from construction of the I-95 realignment justify a reconsideration of the program decision made in 1978 to upgrade the Shore Line. Accordingly, the I-95 realignment is not the subject of detailed analysis in this FEIS/R. However, extending electric traction to the existing Shore Line Route would not preclude implementing this alternative routing at some future time if the necessary funding were to become available.

Airline Route. A few comments on the DEIS/R for the proposed electrification project suggested that the "Airline Route" should be considered as an alternative to the Shore Line Route between New Haven and Boston (see Figure 2.2-1). This route departs the NEC main line in New Haven at Airline Junction and proceeds through Middletown, CT, Willimantic, CT, Putnam, CT, and Franklin, MA, and rejoins the NEC main line at Readville, MA. The total distance between South Station and New Haven over this route is 132.7 miles, approximately 24 miles shorter than the Shore Line Route. Approximately 11.4 miles of this route utilize the Shore Line Route; therefore, the total mileage of new rail route involved in this alternative would be 121.3 miles.

This route was developed in the late 1800s in two different segments. The New York and New England Railroad (and its predecessors) developed that part of the route between Boston and Willimantic, and the New York, New Haven, and Hartford Railroad (the New Haven Railroad) developed that part of the route between New Haven and Willimantic.[14] The *Official Guide*[15] for June 1895 shows a joint routing over the Airline between Boston and New York City (Grand Central Terminal) with a trip time of 5:40.

The New York and New England Railroad was undercapitalized during most of its life and fared poorly in its competition with the New Haven Railroad, often flirting with bankruptcy. It finally fell under the control of the New Haven Railroad in 1896. The New Haven Railroad then offered a train named the "Airline Limited" with a Boston to New York City trip time of 5 hours. This compared to the trip time of the "Shoreline Express" of 6 hours. However, the 1903 *Official Guide* shows that through-service over the Airline Route had been discontinued, with the New Haven Railroad focusing on express service over the Shore Line and a through route that used the Airline Route from Boston to Willimantic, then on to Hartford and New Haven. By 1930, passenger service between New Haven and Willimantic had been discontinued although freight service remained. In 1962, a short segment of the Airline Route just west of Putnam was abandoned. Subsequently, the majority of this route has also been abandoned. Table 2.2-3 presents the existing status of the former Airline Route.

The Airline Route, while shorter than the Shore Line, has substantial grades and curves which may be indicative of the undercapitalization of its builder and, thus, a desire to avoid costly civil works such as cuts or tunnels. This route crosses six rivers including the Connecticut at Middletown and the Willimantic and passes through several extensive freshwater wetlands. It passes through Wadsworth Falls State Park, Salmon River State Forest, James L. Goodwin State Forest, Natchaug State Forest, and Douglas State Forest. In these parks and forests, the remains of the roadbed have been converted to recreational trail use.[16] A significant issue in redeveloping this route in this area is Section 4(f) of the Department of Transportation Act which restricts the Secretary of Transportation's ability to approve projects that require the acquisition and use of publicly owned park land.

The condition of the infrastructure on this route is generally deteriorated or nonexistent. As a consequence, an almost entirely new rail line would have to be constructed for the 103 miles between Airline Junction and Milford Branch Junction, and significant upgrading would be required on the 18.6-mile segment between Milford Branch Junction and Readville. This also would offer the opportunity to address some of the grades and curves and relocate the route from the center of several small towns.

Such new construction would require extensive excavation and grading and the construction of bridges over and in waterways and wetlands, with resulting potential impacts on vegetation, wildlife, soil erosion, water quality, and other construction-related impacts. Impacts from operation of the rail facility would primarily represent a transferral of these impacts from the Shore Line to the new route. Because of the smaller population along the Airline Route, these impacts, such as noise, would impact fewer persons along that route than along the Shore Line.

The Airline Route would also eliminate impacts of high-speed train service on marine traffic using the five moveable bridges in Connecticut that are part of the Shore Line Route (see Section 4.2) and on the scenic values of the Connecticut shore (see Section 4.11).

Use of the Airline Route would bypass the stations on the Shore Line including three that would be served by the proposed high-speed service: Providence and Route 128, which are served by all trains, and New London, which

will be served by at least three express trains per day. It is assumed that a new suburban Boston station would be built. It is also assumed that Amtrak would continue to operate its current local service over the Shore Line in a manner analogous to the current Inland Route service.

The elimination of high-speed service to Rhode Island and New London would cut into the potential market for the NEC high-speed trains, but this might be offset, to some extent, by reductions in trip time that could make the service more attractive to the areas served.

There has been no detailed engineering study to develop the cost of an upgrade of the Airline Route to accommodate high-speed service proposed by Amtrak. Using the TRB estimates for a new, dedicated line and Amtrak's consultant's estimates for a Shore Line realignment, it can be estimated that the cost of establishing high-speed service between Boston and New Haven on the Airline Route would range between $2.3 and $3.9 billion. The time required to complete this project would probably be on the order of 10 to 14 years. For all of these reasons, in addition to the significant environmental impacts involved, FRA does not believe that the benefits to be derived from construction of a new main line along the Airline Route justify a reconsideration of the program decision made in 1978 to upgrade the Shore Line Route. Accordingly, it is not the subject of detailed analysis in this FEIS/R.

2.2.4(c) Conclusion on Routes

PEIS. The PEIS concluded that to meet the required system goals of improved trip times with available resources by the required date, the proposed routing via the Shore Line between New Haven and Boston was the preferred alternative.

1994 Update. In updating the program alternatives considered in 1978 when FRA made its NECIP program decision, no change in circumstance has established an alternative route as clearly superior from an environmental standpoint to the program decision made by FRA in 1978 to improve the Shore Line. The different alternative routes would lessen or eliminate the impacts associated with NECIP in certain specific areas. This would be offset by the significant impacts associated with construction of these new routes as well as the transference of many of the operational impacts to other areas. In addition, the time required to obtain necessary permits and approvals, and to construct alternative routes, would substantially delay the environmental benefits that will be derived from high-speed rail service between Boston and New York City. Moreover, each of the route alternatives has significantly higher capital costs. At this time, the necessary capital to implement these alternatives is not available and it does not appear likely that it will become available in the foreseeable future. This calls into question the viability of these alternatives. Accordingly, since none of the route alternatives would accomplish program objectives within the time frames and funding available for upgrading high-speed rail service between New York City and Boston, nor would they offer clear environmental advantages over the Shore Line, they will not be addressed further in the FEIS/R.

2.2.5 Overall Conclusion

PEIS. The PEIS recommended a specific program of improvements for meeting NECIP statutory goals of improving intercity rail passenger service between Washington, DC, and Boston, MA. These included route realignments, upgrading of tracks, overhead bridges, tunnels, signals, traffic control and communications systems, fencing and station and maintenance facilities, elimination of grade crossings, as well as the electrification of the NEC mainline north of New Haven.

1994 Update. Most of the improvements contained in the preferred program have been undertaken or are in progress. A major portion of the preferred program not yet begun is the proposed electrification of the Shore Line from New Haven to Boston. The remainder of this alternatives section will address the specific proposed project that is the subject of the pending decision before FRA: whether or not to fund extension of electric traction between New Haven and Boston. The non-electric technology options are carried forward for consideration as part of the No-Build Alternative.

TABLE 2.2-3 Airline Route by Status, Ownership, and Track Class

STATUS	MILES	PERCENT OF TOTAL
Freight Service Only	27.8	20.9
Passenger Service Only	8.8	6.6
Passenger & Freight Service	22.3	16.8
Out of Service	73.8	55.6
TOTAL	132.7	100.0

LINE SEGMENT	MILES	STATUS	OWNERSHIP	TRACK CLASS
Union Station - Airline Junction	1.6	Passenger & Freight	Amtrak	Class VI
Airline Junction - Portland	23.3	Freight Service Only	Conrail & Conn DOT	Class II
Portland - CVRR Junction	27.2	Out of Service	CT DEP & Unknown	Inoperable
CVRR Junction - Willimantic	1.1	Passenger & Freight	Central VT Railroad	Class III
Willimantic - Kendall	1.7	Freight Service Only	P&W Railroad	Class I
Kendall - Putnam South	22.5	Out of Service	CT DEP	Inoperable
Putnam South - Putnam North	1.3	Freight Service Only	P&W Railroad	Class III
Putnam North - J&J Plant	24.1	Out of Service	CT DEP & Unknown	Inoperable
J&J Plant - Milford Branch Jct.	1.5	Freight Service Only	J&J Box Company	Class I
Milford Branch Jct. - Readville	18.6	Passenger & Freight	MBTA	Class III
Readville - Back Bay Station	8.5	Passenger Service	MBTA	Class VI
Back Bay Station - South Bay Wye	1.0	Passenger & Freight	MBTA	Class VI
South Bay Wye - South Station	0.3	Passenger Service	MBTA	Class VI
TOTAL	**132.7**			

Source: DMJM/Harris, 1994

2.3 ALTERNATIVES RAISED IN THE SITE-SPECIFIC DEIS/R SCOPING PROCESS

Following appropriation of funds to extend electrification from New Haven to Boston, FRA initiated this EIS/R in 1991 pursuant to the requirements of NEPA and MEPA. A Notice of Intent (NOI) describing the project and soliciting comment on the environmental study was published in the *Federal Register* on October 21, 1991, and Federal scoping sessions were held in November 1991. A project Environmental Notification Form (ENF) was published in the Massachusetts *Environmental Monitor* on August 7, 1992, and a state scoping session was held on August 21, 1992, in accordance with MEPA requirements. As a result of the state scoping process, FRA was authorized by the Secretary of the Massachusetts EOEA to prepare a combined DEIS/R. Appendix C provides a detailed description of the scoping process and the broader public involvement program for the project.

The preliminary list of alternatives proposed for evaluation in this FEIS/R included those raised at MEPA and NEPA scoping sessions and in comments on the DEIS/R by the public, the railroad industry, and environmental or transportation agencies; and those identified by members of FRA staff and other experts in the railroad industry. Trade publications and other relevant literature were also reviewed in order to identify potential alternatives.

A total of 13 alternatives were identified as possibilities. These fell into two basic categories: alternate power systems (non-electric) (eight alternatives), and alternate forms of electrification (five alternatives). As discussed earlier, FRA is constrained in its ability to implement non-electric alternatives. As a consequence, the power system alternatives are considered as part of the No-Build Alternative.

The following sections describe these alternatives and the screening criteria that were applied to select those alternatives that would be the subject of detailed analysis in this document.

2.3.1 Screening Criteria

Alternatives raised in the scoping process for this EIS/R and comments received on the DEIS/R were evaluated according to the following criteria:

- *#1 - Travel Time Savings:* the extent to which the alternative facilitates achievement of the primary goal of NECIP -- a significant improvement in travel time (to 3 hours or less) along the corridor over the existing condition between Boston and New York City.

- *#2 - Technological Feasibility:* the maturity of the technology proposed for attaining improved travel time and whether the technology would be available for project implementation.

- *#3 - Environmental or Financial Costs:* the anticipated construction-related and long-term environmental impacts of the alternative, the financial investment required for implementation, and whether these costs and impacts are realistic and reasonable in comparison to travel time savings and other benefits.

- *#4 - Minimizing/Eliminating Redundancy:* the degree to which a proposed alternative has alignment, power system, or operating and service characteristics that are similar to another alternative such that these two alternatives can be considered in one representative alternative for the purposes of the detailed analysis.

2.3.2 Non-Electrification Alternatives

Two categories of alternate power systems (non-electric) were identified: (1) those that required a locomotive change at New Haven to permit non-electric operation between New Haven and Boston (Alternatives #1 and #2), and (2) those that operated with a dual mode locomotive thus eliminating the need for a locomotive change at New Haven (Alternatives #3 through #8).

2.3.2(a) Change of Locomotives at New Haven

Two alternatives were identified that involved a change of locomotives at New Haven.

Diesel-Electric Locomotive with Locomotive Change at New Haven (Alternative #1).
Description: This alternative is analogous to the existing Amtrak operation between Boston and New Haven. Amtrak trains operating along this segment of the NEC are pulled by diesel-electric locomotives. At Union Station in New Haven, the diesel-electric locomotives are removed and replaced with electric locomotives for the remainder of the trip to New York City (or on to Washington). The locomotive change at New Haven accounts for approximately 10 to 20 minutes of the overall travel time between Boston and NYC.

Reason for Consideration: This alternative is carried forward into the FEIS/R as one of the scenarios in the No-Build Alternative to serve as the environmental baseline because it most closely approximates a continuation of current Amtrak operations.

Gas Turbine Locomotive with Locomotive Change at New Haven (Alternative #2).
Description: This alternative is a variant of the existing operation between Boston and New Haven utilizing a gas turbine locomotive instead of a diesel-electric. At New Haven, the gas turbine locomotive would be replaced by an electric locomotive to permit electric operation through New York City and points south.

Reason for Elimination: This alternative was eliminated from further analysis because of screening criterion 4, eliminating redundancy. Non-electric locomotives with performance characteristics similar to existing equipment operating between Boston and New York City, and to advanced gas turbine equipment, are considered as scenarios in the No-Build Alternative. A gas turbine with locomotive change alternative would not be substantially different from these alternative scenarios.

2.3.2(b) Dual-Powered Diesel-Electric, Gas Turbine or Alternate Power (Non-Electric) Locomotives

Six alternatives were identified that were based on using a locomotive that would operate in a diesel-electric, gas turbine or alternate power mode between Boston and New Haven or New York City and would have the ability to convert to electric power to avoid the present change in locomotives at New Haven.

Diesel-Electric Locomotive with Third Rail Electric Capability (Alternative #3).
Description: This alternative would consist of a traditional diesel-electric locomotive with the addition of train power pickup and conversion capabilities to permit electric operation over third rail. This type of locomotive is presently operated by Metro North Commuter Railroad between Poughkeepsie, NY, and New York City, NY. The locomotive would operate in the diesel-electric mode between Boston and New York City, then shift to electric operation in the New York City tunnels and Pennsylvania Station.

Reason for Elimination: This alternative using existing diesel locomotive designs failed screening criterion 1. It would offer no improvement in trip times over the present service between New Haven and Boston because the travel time savings resulting from the elimination of the locomotive change at New Haven would be offset by the inferior performance capabilities of this locomotive (slower acceleration and deceleration) relative to electric locomotives on the New Haven to New York portion of the NEC. Advanced diesel-electric designs are discussed in the context of advanced non-electric locomotives as part of the No-Build Alternative.

Diesel-Electric Locomotive with Catenary Electric Capability (Alternative #4).
Description: This alternative is similar to the diesel-electric locomotive with third rail electric capability. It utilizes the catenary system for electric operation rather than a third rail.

Reason for Elimination: This alternative failed screening criteria 1 and 2. This type of operation would theoretically save more travel time than the operation discussed (diesel-electric locomotive with third rail electric capability) because of the superior performance of catenary over third rail for electrical pickup at higher speeds. However, this option could not match the performance of an all-electric service with its higher top speed and greater acceleration and deceleration characteristics. Finally, this alternative fails screening criterion 2 because

the technology for this type of locomotive is not currently available, and it is doubtful that it could be fully developed for implementation in the foreseeable future.

Liquid Natural Gas Locomotive with Third Rail Electric Capability (Alternative #5).
Description: This alternative would use a locomotive that burns liquid natural gas (LNG) instead of traditional diesel fuel. Experiments with such locomotives are in progress on a number of freight railroads. The basic engine design would be a diesel engine; therefore, the performance would be similar to the diesel-electric alternative described as Alternative #3 above.

Reason for Elimination: The performance of this alternative is similar to Alternative #3 and was eliminated for the same reasons.

Gas Turbine Locomotive with Third Rail Electric Capability (Alternative #6).
Description: This alternative would consist of a gas turbine locomotive with the addition of train power pickup and conversion capabilities to permit electric operation over third rail. This locomotive is similar to the Rohr *Turboliner (RTL)*, currently in operation on the Empire Corridor between Buffalo, Albany, and Pennsylvania Station in New York City. This alternative is incorporated into the discussion of advanced non-electric locomotives as part of the No-Build Alternative.

Non-Electric Locomotive Capable of 125-MPH Operation (Alternative #7).
Description: This alternative would consist of a non-electric locomotive capable of speeds of 125 mph and fitted with train power pickup and conversion equipment to permit electric operation over third rail in the New York City tunnels.

Amtrak has included as part of its high-speed equipment acquisition program, two (of 28) trainsets that will be powered by non-electric locomotives and capable of speeds of 125 mph. This equipment is discussed in the context of advanced non-electric locomotives as part of the No-Build Alternative.

Non-Electric Locomotive Capable of 150-MPH Operation (Alternative #8).
Description: This alternative would consist of a non-electric locomotive capable of speeds of 150 mph and fitted with train power pickup and conversion equipment to permit electric operation over third rail in the New York City tunnels.

Facilitating development of a high-speed non-electric locomotive/trainset capable of 150+ mph is a major element in the Clinton Administration's High-Speed Rail Initiative. This alternative represents the next technological step beyond existing non-electric systems and is discussed as part of the No-Build Alternative.

2.3.3 Electrification Alternatives

Two types of alternatives were identified for electrifying the NEC between Boston and New Haven: (1) a catenary system using overhead cable of various voltage and frequency (Alternatives #9 through #11), and (2) an electrified rail, hereafter referred to as third rail, running along the tracks (Alternatives #12 and #13). Each of these alternatives is described below.

2.3.3(a) Alternative Catenary Systems

Catenary systems typically consist of an overhead catenary wire for train power pickup. Three alternative catenary supply systems were identified:

11.5 kV-25 Hz System (Alternative #9).
Description: Power is supplied by an 11.5 kV-25 Hz system, as currently used between New York City and Washington.

Reason for Elimination: Alternative #9 fails screening criterion 4 in that it is similar from an environmental perspective to the 2 x 25 kV-60 Hz system (see Alternative #11).

12.5 kV-60 Hz System (Alternative #10).
Description: Power is supplied by a 12.5 kV-60 Hz system, similar to the system in use between New Haven and New York City.

Reason for Elimination: As with Alternative #9, Alternative #10 fails screening criterion 4 in that the system is similar from an environmental perspective to the 2 x 25 kV-60 Hz system.

2 x 25 kV-60 Hz System (Alternative #11).
Description: This system is the system proposed by Amtrak. It is similar to that in use by the French TGV and many other high-speed rail systems abroad.

Reasons for Consideration: This alternative is evaluated in detail in the FEIS/R as Amtrak's Proposed Action.

2.3.3(b) Electric Third Rail

Two alternatives were identified involving the use of electric third rail (installation of a 600 to 750 volt DC traction feed system from Boston to New Haven, similar to that used by the Long Island Railroad, British Rail, and most urban subway systems). These alternatives are:

Third Rail Electric Locomotive with Locomotive Change in New Haven (Alternative #12).
Description: This alternative would involve the installation of electric third rail between Boston and New Haven with a change in locomotives in New Haven to allow operation under the existing overhead catenary AC system between New Haven and New York City and points south.

Reason for Elimination: This alternative fails screening criterion 1. It would not provide any significant time savings over the existing operation since third rail electric locomotives do not have top speeds significantly better than diesel-electric locomotives, and the locomotive change at New Haven would continue to take between 10 and 20 minutes. A greater number of substations would be required between New Haven and Boston, adding to cost and, potentially, environmental impacts. In addition, as noted in the PEIS discussion in Section 2.2.3, this alternative would require the presence of lethal voltages on the NEC trackbed which would present a significant public safety hazard even with additional fencing.

Third Rail Electric Locomotive with Catenary Electric Capability (Alternative #13).
Description: This alternative would also require placement of electric third rail between Boston and New Haven. The locomotive would operate under the third rail from Boston to New Haven and under the existing catenary from New Haven to New York and points south.

Reason for Elimination: This alternative fails to meet screening criteria 1, 2, and 3. Operations of this type would not provide any significant time savings over the existing operation since the time saved as a result of the elimination of the locomotive change in New Haven would be eaten up as a result of certain performance capabilities that would be expected with this type of locomotive (the conversion from AC to DC current would add equipment and hence weight to the locomotive, and would reduce operating speeds). Furthermore, this type of locomotive does not currently exist in the United States or abroad. In addition, a greater number of substations would be required adding to cost and, potentially, environmental impacts.

The results of the screening of alternatives considered in this environmental analysis are tabulated in Table 2.3-1.

TABLE 2.3-1 Preliminary Alternatives Considered

ALTERNATIVES	FAILS CRITERIA			
	1	2	3	4
Alternate Power Systems (Non-electric)				
· *Retaining locomotive change at New Haven*				
1. No-build Alternative, or diesel-electric locomotive with change at New Haven				
2. Gas turbine locomotive with change at New Haven				X
· *Dual-Powered Diesel-Electric or Gas Turbine Locomotive with Electric Capability*				
3. Diesel-electric locomotive with third rail electric capability	X			
4. Diesel-electric locomotive with catenary electric capability	X	X		
5. LNG locomotive with third rail electric capability				X
6. Gas turbine locomotive with third rail electric capability				
7. Non-electric locomotive capable of 125-mph operation with third rail electric capability				
8. Non-electric locomotive capable of 150-mph operation with third rail electric capability				
Alternate Forms of Electrification				
· *Alternative Catenary Systems*				
9. 11.5 kV - 25 Hz system (as used between NYC and DC)				X
10. 12.5 kV - 60 Hz system (as used between New Haven and NYC)				X
11. 2 x 25 kV - 60 Hz system (similar to high-speed rail abroad)				
· *Electric Third Rail*				
12. Third rail electric locomotive with change at New Haven	X			
13. Third rail electric locomotive with catenary electric capability	X	X	X	

Notes: Alternatives highlighted in bold type indicate those evaluated in the FEIS/R.

Source: DMJM/Harris, 1994

2.4 ALTERNATIVES ANALYZED IN THIS FEIS/R

Two groups of alternatives were carried forward into the FEIS/R for detailed analysis. Each is described below.

2.4.1 No-Build Alternative

If the electrification project does not proceed, it is uncertain what actions, if any, would be taken to improve rail passenger service in the Boston to New York City portion of the NEC. The DEIS/R discussed the No-Build Alternative in the context of no significant changes to the existing trip time and locomotive technology used between Boston and New York City.

A number of comments on the DEIS/R raised the possibility of advanced non-electric locomotives or trainsets as alternatives to electrification. The comments pointed to past experience with high-performance non-electric passenger equipment, in particular those powered by gas turbines. They also pointed to opportunities to advance the state of the art of non-electric equipment. FRA agrees that an expanded discussion of such technologies will aid in the discussion of options for high-speed service between Boston and New York City. Accordingly, FRA has expanded the No-Build Alternative in the FEIS/R to address existing and proposed non-electric technologies.

Three scenarios of what might happen in the event that the proposed electrification project does not proceed are considered. These three scenarios are:

- No-Build AMD-103
- No-Build FF-125
- No-Build FRA-150

These alternatives are described below.

2.4.1(a) No-Build AMD-103

If a decision is made not to proceed with electrification, then Congress could reprogram the funds appropriated for electrification and other NECIP improvements for some purpose unrelated to the NEC. Under this scenario, Amtrak would maintain its existing level of service between Boston and New York City with its top-of-the-line diesel locomotive, the AMD-103. This scenario is the basic No-Build Alternative analyzed in detail in the DEIS/R.

The No-Build AMD-103 scenario would consist of continuation of the existing operation of diesel-electric trains between Boston and New Haven with a switch at New Haven to an electric locomotive for the trip to New York City. It is estimated that a slight increase in ridership demand would develop under this alternative, necessitating two additional daily trips in each direction by the year 2010. This alternative would involve 12 trains in each direction on an average weekday between Boston and New York. Amtrak would continue to offer 3-hour and 55-minute express service between New York's Pennsylvania Station and Boston's South Station with stops at Back Bay, Route 128, Providence, and New Haven stations. Conventional (local) service would operate on a schedule of approximately 5 hours and include several additional stops. Included within these schedules is the 10 to 20 minutes required to change locomotives at New Haven.

The diesel locomotives which currently power the trains, known as the F-40, would be replaced with General Electric AMD-103 locomotives currently being delivered to Amtrak. The top speed of these locomotives is 103 mph. Although of contemporary design and easier to maintain, the performance characteristics of these locomotives as they would affect the environment will closely resemble the locomotives they replace. This alternative would not require construction of any new facilities; however, maintenance and upgrades of existing facilities might be required.

2.4.1(b) No-Build FF-125

As a second option, if a decision is made not to proceed with electrification, Congress might provide funding for new non-electric trainsets. Amtrak's high-speed equipment purchase includes two trainsets (of 26 total) that would be powered by non-electric locomotives capable of speeds up to 125 mph. These trainsets, which are intended for use on corridors feeding into the NEC main line, would be identical in all other respects to the 24 trainsets to be powered by electric locomotives. Under this scenario, the northern end would not be electrified, and the two fossil fuel trainsets would become the lead units of a fossil fuel fleet providing service between Boston and New York City. All other planned NECIP improvements would also be undertaken.

FRA's discussions with participants in Amtrak's high-speed rail equipment competition indicate that the designs will be conservative and will be based on incorporating the best of proven technologies into a locomotive rather than advancing the state of the art. This alternative then serves as a surrogate for state-of-the-art non-electric operation. The assumptions that will be used for this analysis are based on the demonstrated capabilities of non-electric passenger rail equipment. In developing the assumptions for use in this alternative, FRA has reviewed the current state of non-electric locomotive design as well as some past experience with advanced designs. The following discussion summarizes recent experience with representative examples of advanced non-electric rail equipment operated or demonstrated in this country, which were used in developing assumptions for the No-Build Alternative - FF-125 Scenario.

United Aircraft TurboTrain.

Description: In 1966, the Department of Commerce's Office of High-Speed Ground Transportation (which became part of FRA upon creation of the Department of Transportation in 1967) contracted with United Aircraft Corporate Systems Center for demonstration on the Boston to New York City portion of the NEC of a lightweight gas turbine train incorporating advanced technical features. The first *TurboTrain* came off the assembly line in the summer of 1967 and the commercial demonstration began on April 8, 1968. The TurboTrains were the first complete self-powered intercity passenger train consists to go into service in the U.S. in nearly 20 years. During the testing of this train in December 1967, it reached a top speed of 170.8 mph on the NEC north of Trenton, New Jersey.

TurboTrains were produced as trainsets, i.e., semipermanently connected power cars and passenger cars that are operated and maintained as a unit. Among the advanced concepts incorporated into the *TurboTrain*, in addition to gas turbines originally designed for aircraft operation, were swivel trucks, guided axles, and a passive tilt suspension system that permitted substantially faster speeds through curves. *TurboTrains* also had a low center of gravity and a low platform height (31 inches) that required special provisions to serve stations with high platforms. The trains were very lightweight when compared to conventional diesel or electric trains. The original three-car *TurboTrain* consist weighed, in total, about the same (105 tons) as a single AEM-7 electric locomotive (102 tons). The lighter weight permitted higher acceleration and braking rates. Lighter weight also generates less stress on the track which results in a positive impact on track maintenance requirements. Because of the atypical nature (from a railroad perspective) of this equipment, it was maintained by United Aircraft under contract to FRA in a separate facility at Fields Point, RI.

The *TurboTrain* used five United Aircraft of Canada, Ltd., ST6B gas turbines with a total of 2,000 horsepower (hp) for traction, and used a mechanical drive system. (A sixth turbine supplied electrical power for the train.) The trains were also equipped with a 600 VDC third rail propulsion system for service in New York City's tunnels. The original *TurboTrain* was designed with two power cars and one intermediate car with a total seating capacity of 144. In 1971 and 1972, these trains underwent successive programs of refurbishment, including the addition of two intermediate cars for a total consist of five, with a seating capacity of 240.

Five *TurboTrains* were also built for Canadian National operation in the Toronto to Montreal Corridor. The primary difference in the Canadian version was that it had two additional intermediate cars, with a total train seating capacity of 326. This train used only four of the ST6B gas turbines with a total of 1,600 hp for traction.

A major purpose of the FRA-funded demonstration was to gauge passenger acceptance, and this equipment was well received. At the conclusion of the FRA-sponsored demonstration in January 1973, Amtrak acquired the two *TurboTrains* funded by FRA, and acquired a third in October 1973 from Canadian National, and continued *TurboTrain* operation in its Boston to New York City service. Amtrak operated two trains with the third as a backup. These trains provided two trips per day and were the fastest regularly scheduled trains over this corridor to date, with scheduled trip times between Boston's South Station and New York's Pennsylvania Station as low as 3 hours and 44 minutes.

Amtrak found that *TurboTrains* were costly to operate and expensive to maintain and required additional cars to carry typical NEC passenger loads. When compared to a typical Amtrak train pulled by a diesel locomotive, Amtrak found that the *TurboTrain* was about three times more expensive to maintain and consumed 40 percent more fuel. It is unclear the extent to which this was attributable to the design or to the limited experimental scope of the demonstration that produced this equipment.

Current Status: Amtrak terminated operation of the *TurboTrains* in September 1976. Shortly thereafter, when considering the fate of this equipment, Amtrak estimated that overhaul of the equipment would cost $8 million and disposed of the *TurboTrains* which were then scrapped.[17] Canadian National terminated its *TurboTrain* operation in 1979.

Rhor Turboliners.
Description: Independent of the U.S. efforts, France began engineering studies to adapt aircraft turbines to rail applications in 1966. The French company, ANF Industries, began testing experimental turbine trains in 1967, ultimately achieving a top speed of 197 mph. The outgrowth of this development is the *Rame Turbine à Gaz (RTG)* turbine train which has been tested at speeds up to 162 mph. *RTGs* began commercial service with the French National Railway (SNCF) in May 1973.

Also in 1973, Amtrak purchased six RTG five-car trainsets (referred to as Turboliners) from ANF Industries for use on the Chicago to St. Louis, Chicago to Detroit, and Chicago to Milwaukee corridors. This initial purchase was supplemented in 1976 by the purchase of seven Rhor *Turboliners* manufactured in Chula Vista, California, by Rhor Corporation under license from ANF Industries. *RTLs* are RTG designs modified to meet U.S. buff strength standards, and with a 600 VDC third rail electric capability for operation in the New York City tunnels. These trains were placed in service on the New York City to Albany to Buffalo Empire Corridor and a $14.8-million *Turboliner* maintenance facility was built in Rensselaer, NY.

The six French-built *RTGs* were retired and placed in storage in 1981 as the arrival of new Amtrak equipment took pressure off Amtrak's equipment fleet; *RTLs* also had become relatively costly to operate as fuel costs increased. In 1987 and 1988, Amtrak undertook a program to upgrade the *RTLs*. As originally built, *RTLs* and *RTGs* had Turbomeca Turbo III 1,140-hp engines in each power car for propulsion with Voith hydrodynamic transmissions. The upgrade program replaced one Turbo III in each trainset with the more modern Turbomeca Turbo XII 1,600-hp engines, for a total trainset horsepower of 2,740. This permits the train to operate with one engine in some circumstances and to reduce fuel consumption and maintenance costs. Three of the *RTGs* were also overhauled and modified for third rail electric operation. These modified *RTGs* were retired in the summer of 1994 due to problems with on-board fires.

The *RTLs* in operation on the Empire Corridor are five-car unit trains with a power car on each end, two coach cars, and a food service car. These trains have a seating capacity of 256 including 27 seats in first class. They also have a high-platform design (platform height of 51 inches) and, therefore, are compatible with the high-level platforms of NEC intercity stations.

The current operation of *RTLs* is limited to Amtrak's Empire Corridor between New York City, Albany, and Buffalo. Between Albany and New York City, these trains operate at peak speeds of 110 mph, the fastest Amtrak operation except for the electrically powered trains operating between Washington and New York. This equipment has been well received and is generally viewed positively by its passengers for its modern look, large windows,

and first class accommodations.

Although heavier than *TurboTrains*, the *Turboliners* are light in comparison with standard railroad equipment. The loaded weight of power cars is 81 tons and the other cars weigh approximately 53 tons loaded. The weight per driving axle is 19 tons and unpowered axles average 14.5 tons. The fuel consumption of the turbine is higher than diesel at idle and low speeds, but compares favorably at higher speeds. Amtrak's experience indicates that *RTLs* on the Empire Corridor consume more fuel on a seat-mile or ton-mile basis than diesel-electric locomotives. The turbine engines, however, burn cleaner, and therefore emit fewer pollutants than the diesels. According to Amtrak, *RTLs* require more maintenance, and at higher cost than its diesel-electric equipment. *RTLs* are the only Amtrak trains that require a maintenance technician on board during normal operation.

Current Status: The last *RTG* was produced in 1981, which is the most recent gas turbine passenger locomotive/trainset produced anywhere in the world. The only gas turbine passenger equipment in operation today are approximately 66 *RTG/RTL* turboliners that operate in four countries. These include 55 in France where they are in the process of being retired as SNCF extends electric traction to the lines presently served by the *RTGs*. Amtrak operates four *RTLs* and three *RTGs* on the New York State Empire Corridor. Iran operates four *RTGs*, and Egypt operates three.

Turbomeca, manufacturer of the turbine engines for the *RTG/RTL*, has developed an engine with improved performance for this equipment. FRA is funding the retrofit of an Amtrak *RTL* presently in Empire Corridor service with this new engine to obtain performance data as part of FRA's high-speed non-electric locomotive development program.

LRC.
Description: The Light Rapid Comfortable *(LRC)* originated in 1968 as part of an effort supported by the Canadian Government to develop improved rail equipment for the Quebec City to Montreal to Toronto to Windsor corridor. A prototype locomotive and car were designed and built between 1968 and 1974. The IRC was manufactured between 1975 to 1985 and was powered by Alco 3,725-hp engines driving four conventional DC traction motors. Its most advanced feature is a servo-controlled hydraulically activated carbody tilt system.

The *LRC* prototype was extensively tested in Canada and at FRA's Transportation Test Center at Pueblo, Colorado. During these tests, the LRC reached peak speeds of 130 mph.

VIA-Rail (Canada's equivalent of Amtrak) was forced to withdraw equipment from service temporarily to deal with door and electrical problems, and elected to "lock out" the tilt mechanism.[18]

The *LRC* entered service in 1982 in the Quebec City to Windsor corridor where its maximum speed is 95 mph. Approximately 30 locomotives and 100 cars were supplied to VIA-Rail (Canada's equivalent of Amtrak). The initial tilt design had significant reliability and maintenance problems, and an improved system was fitted into the cars beginning in 1987.

In addition to its revenue service in Canada, the *LRC* has been extensively demonstrated in Canada and the U.S.; it was included as part of the joint FRA-CONEG tests between Boston and New York City in the spring of 1988.

Current Status: The last *LRC* was manufactured in 1975. VIA-Rail is currently considering a program to upgrade its *LRC* fleet including the conversion of these trains to gas turbine prime movers.

General Electric AMD-103.
Description: In mid-1993, Amtrak began to take delivery of an advanced diesel-electric locomotive, the *AMD-103*, that is the first new diesel passenger locomotive designed and built in the United States in over 40 years. This locomotive was developed for Amtrak by General Electric Transportation Systems as a replacement for Amtrak's aging fleet of diesel locomotives.

The *AMD-103* utilizes a 4,000-hp General Electric 7FDL16 diesel engine and incorporates improvements in computer controls, trucks, brakes, and other subsystems. This locomotive has a peak operating speed of 103 mph although it has been tested at speeds up to 110 mph. Based on its first year of operation, Amtrak estimates that the *AMD-103* is 20 percent more fuel efficient than its predecessor.

Current Status: The *AMD-103* began service in 1993 and to date 44 units have been delivered. Amtrak expects to take delivery on an additional 10 of these locomotives by 1995.

No-Build FF-125 Assumptions. Based on FRA's discussions with the prequalified participants in Amtrak's high-speed equipment acquisition and on the review of the current status of non-electric technology that might likely be incorporated into designs developed as part of that acquisition, FRA developed the following assumptions for use in comparing the FF-125 with other alternatives. These assumptions are:

- The trip time and operating characteristics and fuel consumption are those for the upgraded Rhor Turbo (capable of 125 mph) as simulated by FRA for CONEG (3:16 express train trip time assuming no slow orders).[19]

- Other than locomotives, trains are identical to those used under the Proposed Action.

- The service frequency is the same as analyzed under the Proposed Action.

- Air pollutant emissions are based on measurements of similar gas turbine engines.

- Noise is based on actual RTL measurements.

- Vibration is the same as with the Proposed Action since the trainsets are virtually identical to the electric equipment; vibration would be the same as with Amtrak's proposed electric equipment.

- No construction is required for new facilities other than maintenance facilities in New York City and Boston.

2.4.1(c) No-Build FRA-150

As a third option, if a decision is made not to proceed with electrification, Congress might provide funding for new non-electric trainsets with a more advanced design. Rather than acquiring the locomotives to be provided as part of Amtrak's 1994 equipment order, more advanced equipment would be developed.

As part of the Clinton Administration's High-Speed Rail Initiative, the Department of Transportation submitted, in April 1993, proposed legislation that would establish and fund a new high-speed rail technology development program. A major part of this program is FRA's proposal to facilitate development of a high-speed non-electric locomotive/trainset with a top speed of 150 mph+, and an acceleration capability equivalent to the best electric locomotives/trainsets, and which addresses the cost, reliability, and environmental issues associated with past non-electric locomotives.

Representatives of numerous companies have contacted FRA to discuss the development of advanced high-speed non-electric locomotives/trainsets. There are many proposals for research, development, and demonstration of improved equipment or components. As examples, FRA has been approached by designers of several different locomotive or trainset concepts and by representatives of companies designing or manufacturing five different types of prime movers (diesel, gas turbine, diesel-gas turbine hybrid, wankle, and fuel cell) advocating their technologies as the best prime mover for whatever high-speed locomotive/trainset is developed. One aspect underlying all proposals is the need for Federal funds to bear a large portion of the costs associated with design, engineering, prototype development, and testing.

This proposed program would be the next technological step beyond the designs submitted as part of Amtrak's high-speed equipment purchase, and would begin with the development of system performance standards against which various development strategies would be judged. Conceivably, the program could also become involved in the development and testing of advanced components. FRA's current schedule envisions the development of a prototype for testing around the year 2001 and revenue service perhaps 2 years later.

Whether, when, and to what extent FRA's program will achieve its goals is unknown at this time. To date, Congress has not authorized this program. The first issue is availability of funding. FRA requested $10 million for the first year of this program in fiscal year 1994. Congress declined to provide any funds. FRA has requested $6.5 million for fiscal year 1995 for the non-electric locomotive/trainset effort, and $9.5 million for associated efforts; Congress, however, has not enacted the Department's fiscal year 1995 appropriations. As this FEIS/R was completed, the House of Representatives, in its action of FRA's appropriations request for fiscal year 1995, had provided $3 million for this program. The Senate provided no funds for this program. It is unclear at this time whether the program will have the continuing financial resources necessary to achieve its goal. Even if adequate funds are available, there is an element of risk associated with research and development programs as evidenced by the need for Federal funding. Ambitious goals are often not met. The ability of any design to meet FRA's goals will not be known until the prototype is built and tested.

No-Build FRA-150 Assumptions. Under the No-Build FRA-150 scenario, the northern end would not be electrified and FRA's non-electric locomotive/trainset program is assumed to be a success. At the conclusion of that program, the FRA-150 locomotive/trainsets would be procured for the Boston to New York City service. This scenario serves as a surrogate for all the various advanced non-electric development concepts.

- Trip time and operating characteristics of this equipment are the same as the Proposed Action.

- The service frequency is the same as analyzed under the Proposed Action.

- Since the prime mover (diesel, turbine, wankel) is unknown, and improved efficiency of prime movers would be a development goal, fuel consumption and air pollutant emissions are discussed qualitatively and in comparison to the other alternatives.

- High-speed rail noise and vibration suppression is also a development goal of FRA's proposed program and is discussed qualitatively and in comparison to the other alternatives/scenarios.

2.4.2 Amtrak's Electrification Project

Amtrak's proposed electrification alternative consists of a number of elements. It involves a technology which requires new power facilities along the New Haven to Boston corridor segment to permit operation of electrically powered trains. This technology in turn results in certain physical modifications to bridges along the corridor. A final important component of the alternative is development of a number of mitigation measures aimed at reducing or eliminating environmental impacts associated with the project.

2.4.2(a) Operating Characteristics

The Proposed Action is one of several projects necessary to meet the statutory goal of reducing the travel time of intercity rail service between New York City's Pennsylvania Station and Boston's South Station from nearly 4 hours to less than 3 hours for express service and to under 3 hours and 45 minutes for conventional service. The high-speed trains will travel at a maximum speed of 150 mph, with a range of speed increase at any single location of approximately 5 to 50 mph. Table 8.6 in Volume III of the DEIS/R presents the increase in speed at each of the grade crossings on the NEC, which range from 5 to 55 mph.

The express service stops are currently planned for all trains at New Haven, CT; Providence, RI; Route 128 Station in Dedham, MA; and Back Bay Station and South Station in Boston, MA. Amtrak also plans to stop at least three express trains at New London, CT. Conventional service would continue to serve those stations currently served.

In the study area these are Old Saybrook, New London, and Mystic, CT, and Westerly and Kingston, RI, although not all trains make all stops.

2.4.2(b) Electric Technology

Amtrak's proposed electrified traction system consists of two parts: the power *supply* system (utility power line connections and the traction power supply substations), and the power *distribution* system (switching stations, paralleling stations, the overhead catenary). Figure 2.4-1 is a photograph of a catenary system similar to the one proposed for the NEC between New Haven and Boston. Figures 2.4-2 and 2.4-3 show the proposed electrification facility and bridge modification sites.

The electric locomotives on the proposed electric traction system would operate in a manner similar to electric trolley cars: electric power is transferred through the locomotive from a contact wire, which is part of the overhead power distribution system known as the overhead catenary system (OCS). This OCS would be energized at a voltage of 25 kV AC, measured contact wire to rail. This contrasts to some trolley systems energized at 600 or 2,400 volts DC. This higher voltage is necessary to effectively move larger and heavier trains at higher speeds.

Electric power from the OCS is collected by the locomotive pantograph, which maintains contact through uplift forces as the train moves. The pantograph is a collapsible frame extending from the locomotive roof. The power is supplied to the locomotive main transformer primary. Once in the locomotive, the transformer secondary supplies power through various control devices, which in turn provide power to the traction motors mounted on or near the locomotive's axles. A small amount of power is also used for train lighting, heating, air conditioning, and other auxiliary purposes.

The electric traction design proposed by Amtrak is known as a 2 x 25 kV autotransformer system. It includes in the overhead both a contact wire and a feeder, each of which is energized at 25 kV AC. The voltage between the catenary and feeder is twice that of each alone, or 50 kV AC. This effectively creates a 50 kV supply for the system.

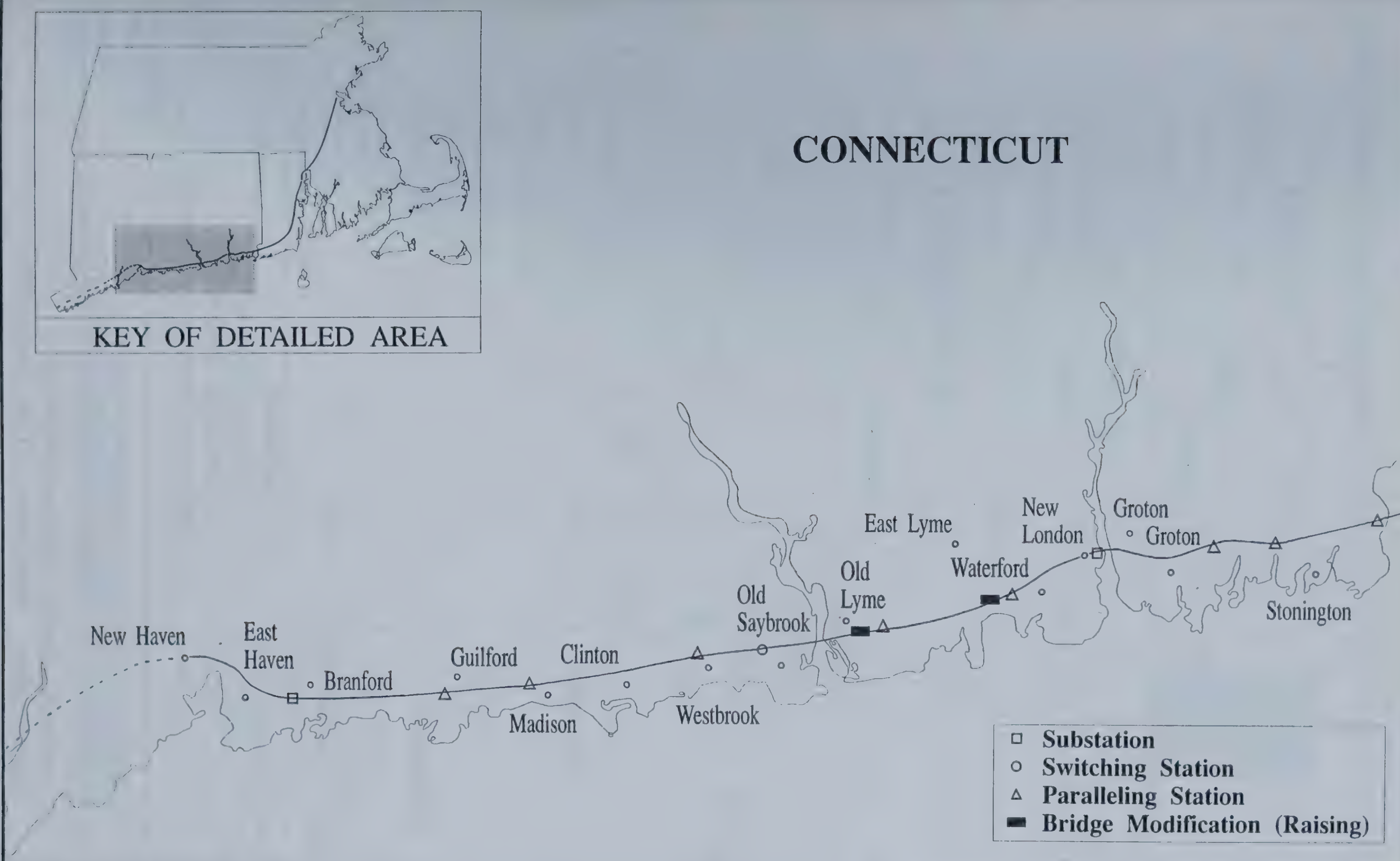
Power Supply System.

Substations and Utility Supply: Railroad power requirements are much like those of a large industry. Electricity from the local utility company is delivered to the substation via a tie-in from the utility's transmissions network. The utility tie-in consists of either overhead or underground wires from local transmission lines to the new substation. Typically, the voltage on the utility's transmission lines is 115,000 volts (115 kV) and is "stepped down" or converted to the 25 kV levels by a transformer at the substation. The 25 kV feed is then connected to the catenary and feeder systems for use by the locomotive. Overhead or underground wires from the substation supply the stepped down power to the overhead catenary and feeder systems.

The traction power supply system for the NEC includes four substations spaced approximately 44 to 53 miles apart, which receive power from the local utilities at 115 kV. Each substation, which is sited in proximity to the ROW, contains transformers which step down the 115 kV to supply the catenary and feeder at 25 kV. The substation locations are listed in Table 2.4-1 and the site plans of the four proposed substations are presented in Appendix A as Figures A-1 through A-4.

Each substation site consists of a fenced area of approximately 0.5 acre. The transformers, as well as circuit breakers, remotely controlled switches, and control monitoring equipment, are contained in this fenced area. Some of these facilities are located inside a small control building (approximately 750 square feet), which is also located in the fenced area.

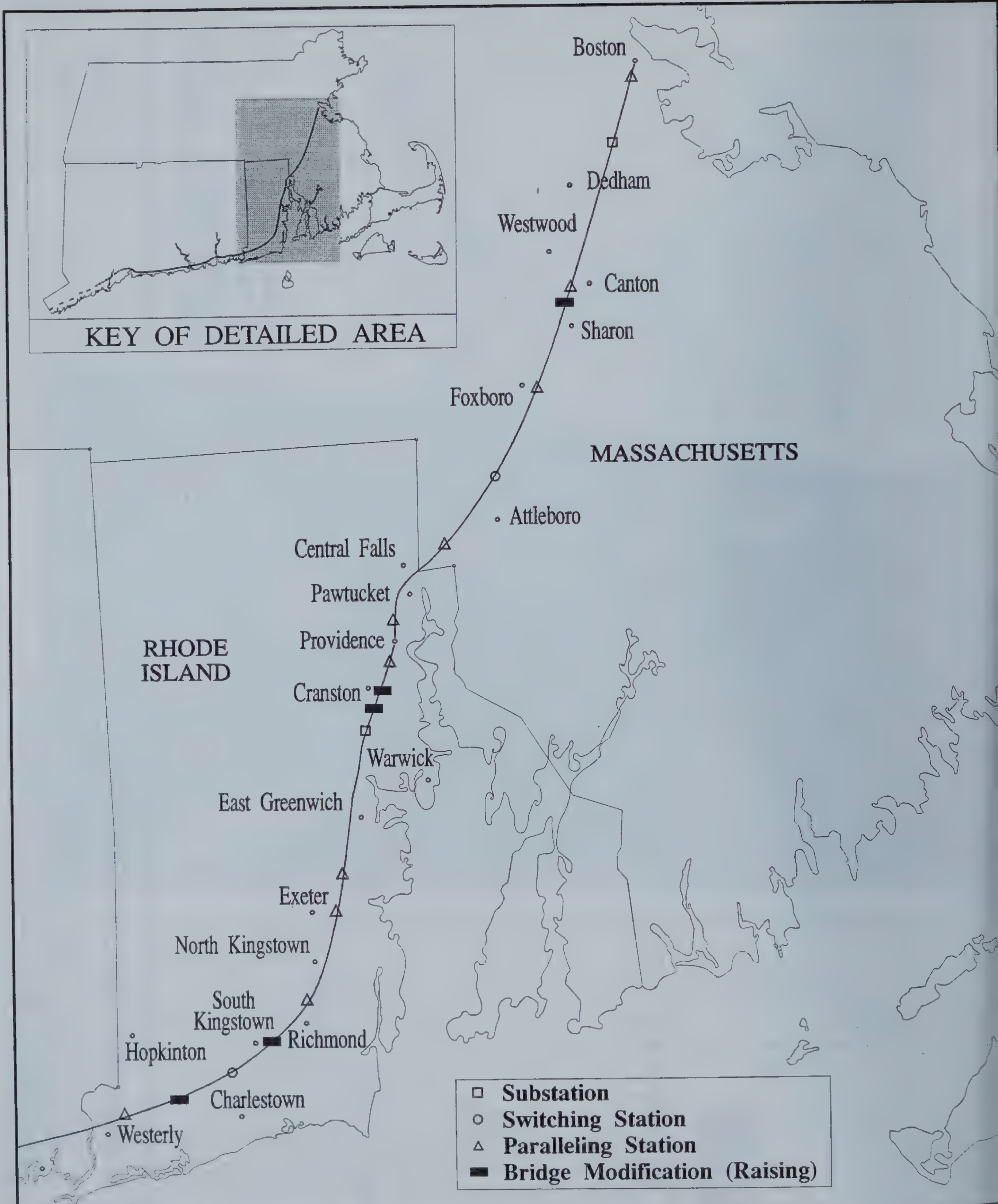
FIGURE 2.4-1. VIEW OF TYPICAL CATENARY SYSTEM SIMILAR TO THE ONE PROPOSED FOR THE NEC.



CONNECTICUT FACILITY AND BRIDGE MODIFICATION SITES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 2.4-2



RHODE ISLAND AND MASSACHUSETTS FACILITY AND BRIDGE MODIFICATION SITES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 2.4-3

TABLE 2.4-1 Electrification Facility Sites

FACILITY	MILEPOST	MUNICIPALITY
Substations		
Branford	79.26	Branford, CT
New London	123.55	New London, CT
Warwick	176.91	Warwick, RI
Roxbury Crossing	226.02	Boston, MA
Switching Stations		
Westbrook	103.74	Old Saybrook, CT
Richmond	150.15	Richmond, RI
Norton	198.99	Attleboro, MA
Paralleling Stations		
Leetes Island	85.99	Guilford, CT
Madison	92.41	Madison, CT
Grove Beach	99.11	Westbrook, CT
Old Lyme	109.50	Old Lyme, CT
Millstone	117.54	Waterford, CT
Noank	129.52	Groton, CT
Stonington	134.65	Stonington, CT
State Line	139.93	Stonington, CT
Bradford	145.19	Westerly, RI
Kingston	157.11	South Kingstown, RI
Exeter	161.78	Exeter, RI
East Greenwich	169.80	North Kingstown, RI
Elmwood	181.49	Providence, RI
Providence	187.45	Pawtucket, RI
Attleboro	193.40	Attleboro, MA
East Foxboro	205.70	Foxboro, MA
Canton	212.38	Sharon, MA
Readville	219.08	Boston, MA

Source: MK/LKC/Spie, 1994

Alternative Substation Sites: There were several comments on the DEIS/R concerning Amtrak's approach to siting of substations and the availability of alternative sites. The Connecticut Siting Council requested a review of alternatives to the Branford and New London substation sites consistent with state procedures. Based on the number of comments on the DEIR to MEPA concerning the proposed substation at Roxbury Crossing, the EOEA Secretary, in the MEPA Certificate issued for the FEIR, requested the identification and comparison of alternatives to this site. The discussions of alternatives to these substation sites are presented in Appendices K and L.

Upon review of the substation alternatives analysis, FRA has included as part of its preferred alternative all of the sites proposed by Amtrak except the one at Roxbury Crossing. Roxbury is the technically superior site. Comments on the DEIS/R, however, expressed concerns that the placement of the substation in a densely populated community across the street from an existing MBTA substation would impact land use and land values in this minority and low-income neighborhood. In evaluating alternative sites for this facility, FRA recently identified a site in the Clarendon Hills section of Boston that may meet the Amtrak's minimum technical needs with potentially less impact upon land use and other issues raised in the context of the Roxbury Crossing site. Further review of these sites is necessary. In particular, given the level of interest in the Roxbury Crossing site, additional input from the neighbors of these two sites is needed.

The proposed electrification project is a large and complex project covering 156 miles in three states. Siting of the northernmost electrical facility is a comparatively small part of the overall project and need not be resolved before making a decision on whether to proceed with the project as a whole. The FEIS/R considers the placement of the substation at Roxbury Crossing as the "worst case" impact and that will be considered in the decision whether to proceed with the overall project. However, over the next few months, FRA proposes to undertake a detailed analysis of the Roxbury Crossing and Clarendon Hills alternative sites. FRA will then work with Amtrak, MEPA, MBTA, the city, and the involved communities to identify the location, design, and mitigation that best meet the needs of the community and the railroads. Once that decision is made, appropriate supplemental environmental documentation will be prepared.

Power Distribution System. The overhead catenary is not electrically continuous along the entire route; rather, it is subdivided into electrical sections of 40 to 55 miles in length, with an isolating section called a phase break between each section. Each electrical section is "fed" power by a substation which in turn receives power from the local utility company serving the area. The power is distributed in the area between phase breaks by the feeder wire which is hung from the catenary structures with the contact wire. These intermediate facilities are smaller than substations and are called switching stations and paralleling stations. These facilities contain small transformers (autotransformers) that connect the feeder to the catenary. By employing the feeder and these smaller facilities, fewer utility supply points (substations and tie-ins) are needed, since power can be carried farther down the rail line than if no feeder and intermediate supply points are used.

The phase breaks between the electrical catenary sections are located at the switching stations, which contain the switchgear necessary to connect across them. They provide flexibility in feeding the catenary sections from an adjacent section, should a section's normal supply suffer an outage.

The phase breaks insulate and isolate catenary sections from one another, but allow a train to pass between them. If a substation loses power, switching (at a switching station) can be performed to isolate the disabled substation and to restore power to the affected catenary section from adjacent sections/substations.

Paralleling Stations: Paralleling station sites can vary in size, with a maximum fenced area of approximately 4,000 square feet or 0.10 acre. The 18 paralleling stations, which are located along the electrical catenary sections served by each substation, each consist of an autotransformer and switch gear to equalize voltage between the two tracks, along with a small control building (approximately 600 square feet). The paralleling station sites are in or directly adjacent to the ROW. Table 2.4-1 lists the paralleling station sites along the corridor and site plans for each station are contained in Appendix A (Figures A-8 through A-25).

Switching Stations: A switching station site consists of a fenced area of approximately 0.15 acre. Each of the three switching stations contains a concrete pad on which is located a small building (approximately 600 square feet). Also included within the fenced area is what is effectively two paralleling stations (two autotransformers and switchgears).

The three switching station sites are located in or directly adjacent to the ROW. Table 2.4-1 lists their locations and Appendix A (Figures A-5 through A-7) contains the site plans for the three stations.

Catenary Installation: The OCS consists of wires suspended 21.5 feet over the railroad tracks supported by steel poles approximately 31 feet high. The poles, which support a cantilevered arm from which the wires are suspended, are wide flange (WF) beams or reinforced WF beams with 8-inch or 10-inch flange widths and would be spaced in pairs on either side of the tracks. Each set of poles is spaced approximately 200 feet from the next pair tangent along the track. Pole locations require a closer interval for curved sections of track with spacings as close as 75 feet on the sharpest curves. A typical catenary pole installation is pictured in Figure 2.4-4.

In areas where more than two tracks are located, and in areas in Connecticut and Rhode Island where a freight rail siding is proposed, a portal structure will be used. A portal structure, illustrated in Figure 2.4-5, consists of two wide flange beams between which a third beam is positioned. The OCS wires are hung below the horizontal beam.

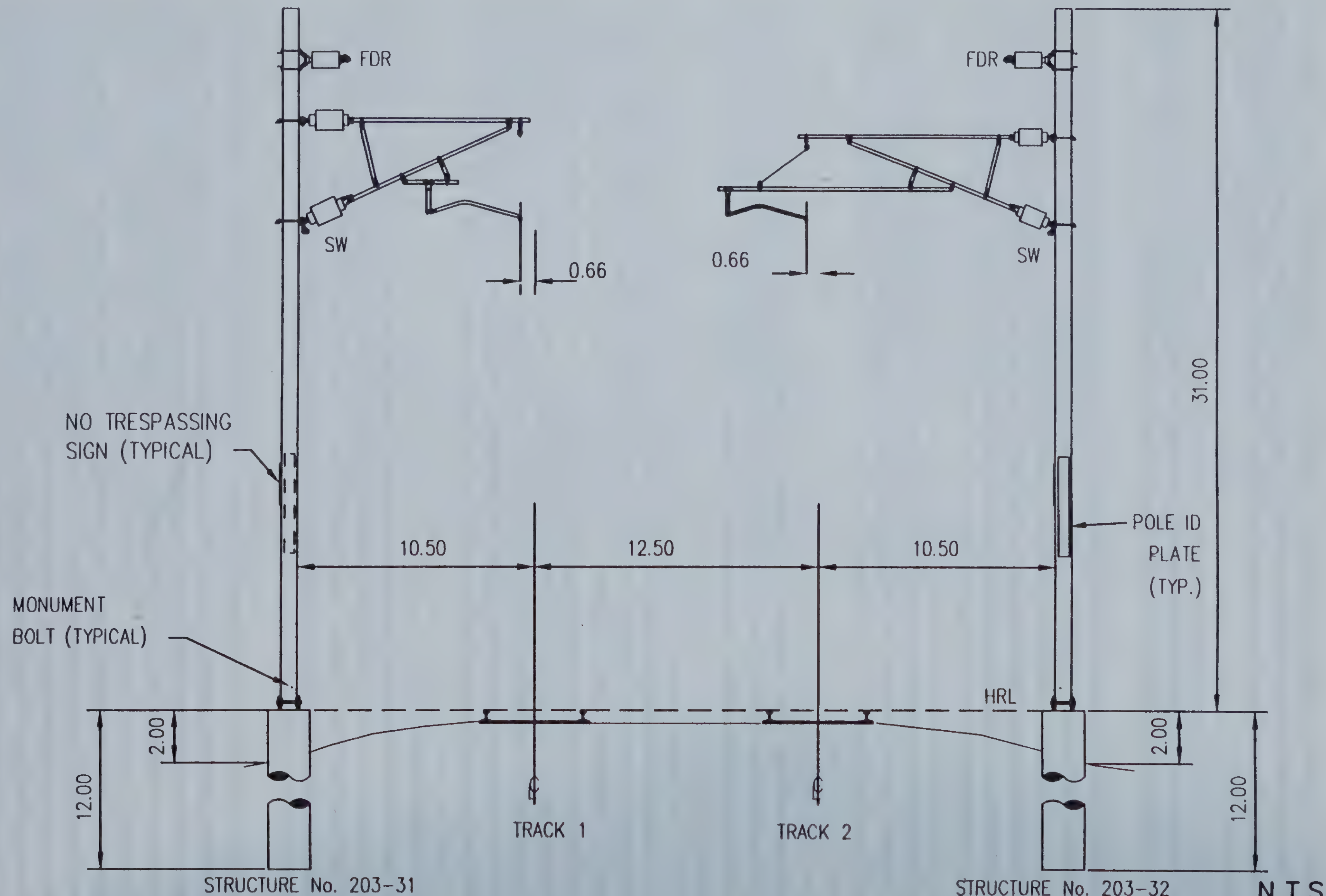
Electric Power Locomotives. Since the early 1980s, Amtrak has employed a fleet of electric locomotives known as the AEM-7 to haul passenger trains between Washington and New Haven where a continuous overhead catenary system has existed since the mid-1930s. These locomotives operate at a maximum speed of 125 mph where track conditions permit.

Amtrak is in the process of acquiring new equipment to replace that which is presently used for *Metroliner* service on the electrified portion of the NEC and which would be used between New Haven and Boston if the extension of electrification is undertaken. This equipment will be capable of 150-mph operation, will exhibit quicker acceleration and deceleration characteristics, and will be able to traverse curves at higher speeds than the existing AEM-7 locomotives. Such locomotives are similar to equipment currently in operation in several European countries. This alternative assumes that Amtrak will employ the new locomotives as express service trains. The present AEM-7 locomotives, which possess a significant remaining useful life, would likely be employed on the somewhat slower conventional trains along the corridor for the first few years of electrified operation.

2.4.2(c) Bridge Modifications

Installation of the OCS will limit the vertical clearance available over the railroad tracks. In some areas of the NEC, overhead structures, such as roadway and pedestrian bridges, currently restrict vertical clearance over the tracks. Where such structures exist, clearance requirements between the overhead structure and the catenary wires, and between the catenary wires and the train, could further reduce the available vertical clearance (see Figure 2.4-6).

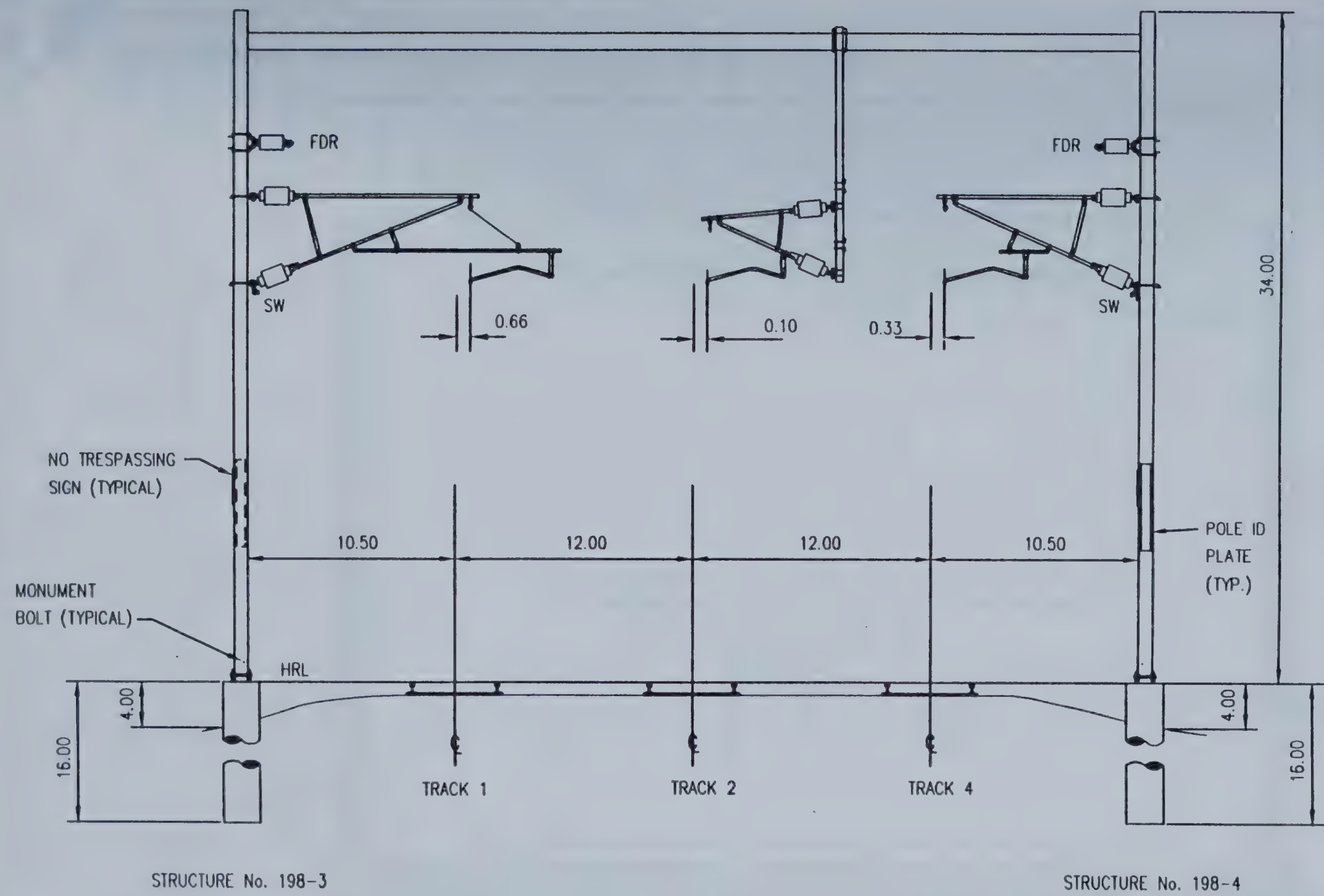
Amtrak has proposed to maintain sufficient vertical clearances between the track and catenary so that all passenger and freight operations currently operating on the NEC can continue. In order to do so, two measures may be undertaken: either the existing railroad track would be lowered or the overhead structure would be raised (in some cases, some combination of both measures may be proposed). Lowering the railroad tracks is preferred to raising the overhead structure for several reasons: (1) the cost is generally lower; (2) no disruption or detouring of roadway or pedestrian traffic is required; and (3) the potential for environmental impacts is usually less because all activity would take place in the existing rail bed. Lowering the tracks is accomplished by undercutting under the tracks, removing an appropriate thickness of the ballast material, and tamping the track into its lower position using a rail tamping machine, which rides along the tracks. The entire operation is performed at a rate of approximately 200 to 300 linear feet of track per 5-hour shift. As Table 2.4-2 indicates, tracks would be lowered at 33 locations along the corridor.



TYPICAL CATENARY POLE INSTALLATION

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure 2.4–4

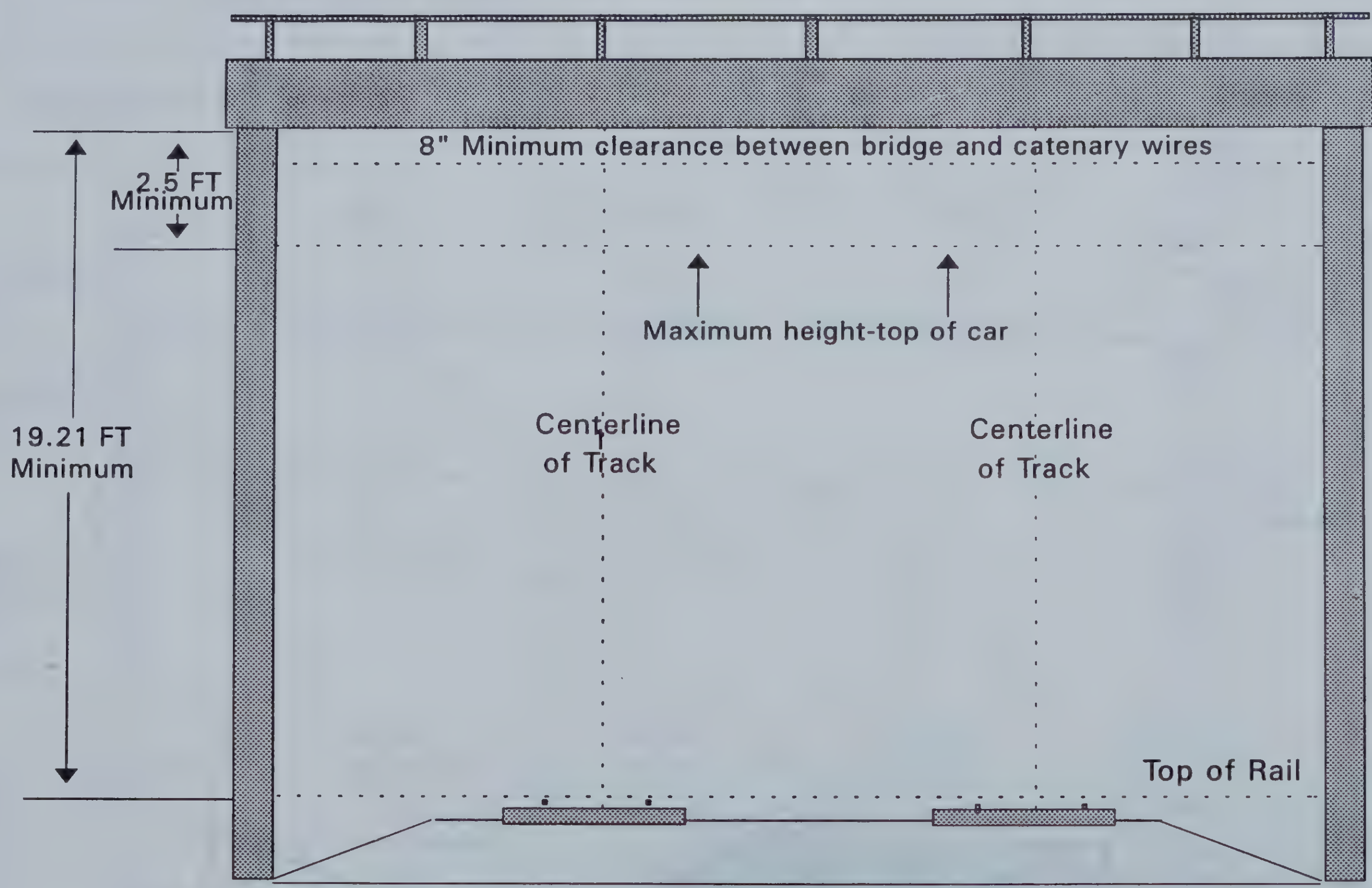


N.T.S.

TYPICAL PORTAL STRUCTURE

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure 2.4–5



CLEARANCE REQUIREMENTS AT OVERHEAD BRIDGES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 2.4-6

TABLE 2.4-2 Bridge Undercutting Locations

BRIDGE	MILEPOST	MUNICIPALITY	UNDERCUTTING QUANTITY (cubic yards)
Harbor Street/Kirkham Street	80.95	Branford	2,931
Birch Road	83.25	Branford	3,318
Vedder's Point Road	84.29	Branford	1,703
Hulls (Fort Path Road)	91.82	Madison	2,274
Copse Road	92.53	Madison	1,327
Grove Beach Road	99.16	Westbrook	2,350
Essex Road	101.36	Westbrook	1,914
School House Road	103.62	Old Saybrook	5,889
Ingram Hill Road	104.15	Old Saybrook	
States' Crossing/Buttonball	109.43	Old Lyme	1,498
Columbus Ave.	115.62	East Lyme	1,409
Elm Street Pedestrian Overpass	136.22	Stonington	1,693
Palmers Neck Road	137.81	Stonington	3,037
Stony Hollow/Green Haven	138.63	Stonington	1,315
High Street	141.77	Westerly	1,838
Main Street	158.32	South Kingstown	4,052
Exeter Road	163.21	North Kingstown	2,224
Route 10	180.69	Cranston	*
Ramp onto Route 95	180.71	Cranston	*
Reservoir Avenue	181.66	Providence	3,074
Cranston Street/Magnaw Road	182.60	Providence	3,151
Gov. Robert's Expressway	183.33	Providence	827
Pawtucket Station	189.88	Pawtucket	*
Washington Street	191.13	Attleboro	1,204
County Street	192.47	Attleboro	2,890
Holden Street	198.01	Attleboro	2,820
Elm Street	201.67	Mansfield	2,947
School Street	202.51	Mansfield	3,252
Tremont Street/Arlington Street	228.13	Boston	*
River Street	220.74	Boston	1,846
Pedestrian Bridge	221.85	Boston	*
Blakemore Street	222.82	Boston	*
W. Fourth Street/Broadway	227.76	Boston	1,115

* Quantity subject to final design

Source: Amtrak, 1994

Raising or replacing an overhead structure is frequently more complicated and more expensive and is required where track lowering alone is not sufficient or other factors prohibit lowering the track enough to attain adequate clearance. Where an overhead bridge is to be raised, some or all of the following activities are required:

- raising the bridge superstructure
- demolition and reconstruction of the bridge superstructure
- modifications to substructures
- reconstruction of approach roadways
- regrading of embankments
- extension of guardrail and curbing

The duration of construction on the seven bridges to be modified ranges from 1 month for Johnnycake Hill Road Bridge in Old Lyme to 4.5 months for the Pettaconsett Avenue Bridge in Warwick, RI. The effect of the construction on pedestrian or vehicular traffic varies substantially depending upon the duration and staging of construction, as well as the availability or difficulty of detour or alternative routes. Table 2.4-3 lists the bridges to be raised. Site plans of the seven bridges are shown in Appendix A.

A summary of the electrification alternative is included in Table 2.4-4.

TABLE 2.4-3 Bridge Modifications

BRIDGE	MILEPOST	MUNICIPALITY	DURATION OF CONSTRUCTION (months)
Johnnycake Hill Road	108.51	Old Lyme, CT	1
Millstone Road (West)	117.31	Waterford, CT	2.5
Burdickville Road	148.41	Charlestown, RI	4
Kenyon School Road	154.04	Richmond, RI	3
Pettaconsett Avenue	178.46	Warwick, RI	4.5
Park Avenue	180.29	Cranston, RI	4
Maskwonicut Street	211.62	Sharon, MA	3

Source: Amtrak, 1993

TABLE 2.4-4 Summary of Electrification Alternative

· Technology & Facilities	· Electric · 4 substations, 3 switching stations, 18 paralleling stations · 2 X 25 kV traction power system · Power distribution via overhead catenary wires · New electric trainsets capable of 150-mph operation
· Bridge Modifications	· Undercutting at 33 bridges · Raisings/replacement at 7 bridges

Source: Amtrak, 1993

ENDNOTES

1. FAA, *1993 Aviation System Capacity Plan*, Chapters 2 and 6.

2. Parsons Brinckerhoff Quade and Douglas, Inc., Cambridge Systematics, Inc., and Regional Science Research Institute, *CONEG High Speed Rail Regional Benefits Study*, Chapter 3, October 1990.

3. FHWA, *1992 Highway Statistics*, p. 190.

4. FHWA, *1993 Conditions and Performance Report*, p. 21.

5. FRA, U.S. Army Corps of Engineers, U.S. Department of Energy, *Final Report on the National Maglev Initiative*, September 1993.

6. FRA et al., *Final Report on the National Maglev Initiative*, op. cit., page 4-4.

7. FRA has published a series of reports documenting its analysis of Transrapid. See for examples *Assessment of the Potential for Magnetic Levitation Transportation in the United States*, June 1990, and *Safety of High Speed Magnetic Levitation Systems -- Preliminary Safety Review of the Transrapid Maglev System*, November 1990.

8. FRA, *Northeast Corridor Improvement Project -- Final Programmatic Environmental Impact Statement*, June 1978, p. 2-57.

9. Edwards and Kelcey for the Massachusetts Bay Transportation Authority, *Draft Environmental Impact Report -- Worcester Commuter Rail Extension Project*, August 1993.

10. Letter from William B. Newman, Jr., Vice President and Washington Counsel, Conrail, to Gilbert E. Carmichael, Administrator, FRA, October 14, 1992.

11. Transportation Research Board, National Research Council, *In Pursuit of Speed, New Options for Intercity Passenger Transport*, 1991, Table 3-4.

12. Parsons Brinckerhoff Quade and Douglas, Inc., *Feasibility Study, Amtrak Shoreline Realignment -- Old Saybrook, CT., to E. Greenwich, R.I.*, March 15, 1991.

13. FRA Offices of Railroad Development, *The Northeast Corridor Transportation Plan - New York City to Boston*, July 1994.

14. A brief history of the New York and New England Railroad can be found in *Formation of the New England Railroad Systems*, by George Pierce Baker, Greenwood Press Publishers, 1968.

15. *The Official Guide of the Railways and Steamship Lines of the United States*. Information in this discussion comes from the Official Guides of June 1895, June 1900, June 1902, June 1916, June 1930, June 1961, and June 1962.

16. U.S. Department of the Interior, Geological Survey, various quadrangle maps, 7.5-minute series

17. Amtrak, *Commitment Approval Request -- Retirement and Sale of Three Turbo Trains and Spare Parts*, 11/16/79.

18. High-Speed Rail Tilt Train Technology: A state of the Art Survey, prepared for Office of Research and Development, DOT/FRA/ORD-92/03, May 1992.

19. *CONEG High Speed Rail Regional Benefits Study*, op. cit.

CHAPTER 3
AFFECTED ENVIRONMENT

A knowledge of the existing (1993/94) physical conditions in the project area is the basis from which the projection of benefits and impacts from the No-Build Alternative scenarios and the Proposed Action are compared. Twelve potential impact areas are evaluated: land use, socioeconomics, historic resources, noise and vibration, electromagnetic fields and interference, energy, archaeology, public safety, transportation and traffic, air quality, visual and aesthetic resources, and natural resources. The following sections provide a description of resources as they occur in the project study area, in addition to the relevant regulations for land use, historic and archaeological resources, noise and vibration, and air quality. Tables referred to in this chapter can be found in Appendix B of this document.

3.1 LAND USE

This section describes the existing land use in the NEC, including identification of sensitive receptors, those land uses that may be particularly sensitive to the impacts of the Proposed Action.

3.1.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.1.1(a) Federal Regulations

Farmland Protection Policy Act (7 USC 4201-4209): This act requires Federal agencies to evaluate adverse effects of Federal actions on the preservation of farmland and to consider alternative actions that could lessen such effects.

Coastal Zone Management Act (16 USC 1451-1464): The Coastal Zone Management Act (CZMA) of 1972 provides states with the authority to establish policies for the protection and use of natural resources in coastal areas, including wetlands, floodplains, and fish and wildlife. States with approved programs must review all Federal funding, permitting, construction, or other actions proposed within the coastal zone for consistency with the state's coastal policies.

Public Law 99-647: This act establishes the Blackstone River Valley National Heritage Corridor and Commission. The purpose of the Act is to provide a management framework to assist local governments in development and implementation of integrated cultural, historical and land resource management programs. Among other things, the Act requires standards and criteria be established for all construction, preservation, restoration, alteration, and use of all properties within the Corridor.

Section 4(f) of the Department of Transportation Act of 1966 (49 USC 303(c)): Section 4(f), as it is commonly known, provides that the Secretary of Transportation may not approve a project that involves use of land from a significant publicly owned park, recreation area, wildlife or waterfowl refuge, or any significant historic site unless: (1) there is no feasible and prudent alternative to the use of the land; and (2) the proposed action includes all possible planning to minimize harm to the property from such use. .

3.1.1(b) State Regulations

Connecticut.

Connecticut Coastal Management Act: This act regulates activities in all areas 1,000 feet inland from coastal wetlands. Any proposed action or project within this area is subject to coastal site plan review and evaluation for consistency with the policies of the act.

Conservation and Development Policies Plan: This is the state's comprehensive plan. One relevant goal is to provide an integrated, efficient, and economical transportation system which provides mobility, convenience, and safety, and which meets the needs of all citizens, including transit-dependent individuals. The plan specifically states that high-speed passenger rail service between Boston and New York with stops in Connecticut is desirable and is feasible through track improvements and electrification.

Environment 2000 Plan: This plan reflects the environmental concerns of the state and the goals, objectives, and strategies for each area of interest. Relevant goals of the plan include protecting public health from harmful exposure to electric and magnetic fields, and from the adverse effects of air pollutants. It also includes the objective of promoting the utilization of vehicles with low-level emissions, and transportation which reduces reliance on single-occupant vehicles.

Rhode Island.
Coastal Zone Management Program: As authorized by the Federal CZMA, the Coastal Resources Management Council (CRMC) implements this program and has regulatory and permitting power for any activities taking place within the 200-foot contiguous area landward of all coastal features.

State Guide Plan: The Rhode Island State Guide Plan acts as the comprehensive plan for the state. Element 611 includes improving existing transportation facilities and services with the goals of promoting reliable and frequent high-speed NEC passenger rail service.

Massachusetts.
Massachusetts Coastal Zone Management Act: The Massachusetts Office of Coastal Zone Management administers the Federal CZMA and requires preparation by the proponent of a Federal Consistency Concurrence for projects involving Federal action (permitting, funding) or for which an EIR is being prepared under MEPA, that are located within the designated coastal zone. The coastal zone boundary for Massachusetts includes all areas inland up to the first major roadway plus 100 feet.

3.1.2 Affected Environment

This section discusses five areas with respect to land use: zoning, existing land use, prime and important farmland, special protected areas, developable land surrounding express stations.

3.1.2(a) Existing Zoning

Zoning ordinances are enacted by local governments to regulate development and protect the health, safety, and welfare of citizens. Since Amtrak is not subject to local or state laws that could impact rates, routes, or service, and because Amtrak has the right of eminent domain (49 U.S.C. 24301(g)), Amtrak maintains that the electrification facility placement would be exempt from local zoning.[1] However, in analyzing the potential impacts of facility sites, it is important to discuss existing zoning characteristics. Table 3.1-1 identifies existing zoning at each site where Amtrak has proposed to locate a facility supporting the electrification of the rail line. As indicated, the Branford, Noank, and Stonington facilities would not be consistent with local zoning designations for those sites.

3.1.2(b) Existing Land Use

The NEC traverses a broad range of land uses. The study area, which includes 0.5 mile on either side of the ROW from New Haven to Boston, contains 96,313 acres of land with the following distribution:

LAND USE	PERCENT
Open	33.68
Residential	27.93
Wetlands	8.95
Commercial	6.44
Transportation	6.41
Industrial	5.85
Agricultural	4.99
Water	3.92
Parks and Recreational	1.83
TOTAL	100.00

As indicated, most of the land is open or undeveloped.

The land uses within each of the 36 municipal jurisdictions through which the NEC passes are described in Table 3.1-2. The table also identifies sensitive receptors: land uses most likely to be affected by the electrification of the main line tracks, or construction of the switching and paralleling stations and the substations, or improvements to bridges. As indicated in Table 3.1-1, the Warwick and Norton sites are inconsistent with existing land uses because they would require the displacement of existing uses.

Southampton Yard. Southampton Yard provides maintenance, fueling, and storage functions for Boston Amtrak operations. The Yard is located adjacent to the Dorchester Branch of the Massachusetts Bay Transportation Authority (MBTA) across Fort Point Channel from South Station. This area is encompassed primarily by other rail uses, highway infrastructure, and industrial uses. Cabot Yard, the MBTA's Red Line and bus maintenance facility, as well as the South Side Maintenance Facility, which supports commuter rail operations, are located directly northeast of Southampton Yard. The nearest residences are approximately 700 feet away from proposed electrified tracks and are substantially buffered by nonresidential uses.

3.1.2(c) Prime and Important Farmland

Prime and other farmland of statewide and local importance are lands on which the soil types possess high agricultural value or lands which are of value because of dependence on them for agriculture. The U.S. Department of Agriculture Soil Conservation Service (SCS) defines prime farmland as the land best suited to produce food, feed, forage, fiber, and oilseed crops. It also has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops; it requires minimal amounts of energy and economic resources; and farming it results in the least damage to the environment. For an area to be identified as prime farmland it must not only contain specific soils but also be used for producing food or fiber or be available for those uses. Thus, urban or built-up land is not considered as eligible prime farmland.

Additional farmland of statewide or local importance is defined as land that is nearly prime farmland which can economically produce high yields of crops when treated and managed according to acceptable farming methods. This type of soil can yield food, feed, fiber, or forage crops. Usually these lands have steeper slopes or are wetter than prime farmland. Some of these lands may produce as high a yield as prime farmland if the conditions are favorable.

Two steps were involved in determining the agricultural value of the proposed facility sites. First, using mapping and aerial photography, the sites were plotted on the SCS Soil Survey maps which categorize areas by soil type. Two steps were involved in determining the agricultural value of the proposed facility sites. First, using mapping and aerial photography the sites were plotted on the SCS Soil Survey maps which categorize areas by soil type. Table 3.1-3 identifies the results of the in-house mapping for each site. Following field inspections performed by the SCS, however, some site classifications changed based on site conditions. In coordination with the Soil Conservation Service, it was determined that five facility sites would be located on sites that contain prime or important farmland soil types. These are: Branford Substation, Richmond Switching Station, and Bradford, Attleboro, and Canton paralleling stations. However, none of these sites is presently used for agricultural production.

3.1.2(d) Special Protected Areas

Coastal Zones. The majority of the corridor between Branford, CT, and Westerly, RI, as well as the area around Greenwich and Apponaug Coves in East Greenwich, RI, and around South Station in Boston, MA, falls within the coastal zone. The coastal zone designation is made by each state in accordance with the Federal CZMA. In Connecticut, the coastal zone encompasses areas 1,000 feet inland from coastal features as designated by the Office of the Long Island Sound Program (LISP). In Rhode Island, the coastal zone encompasses areas 200 feet inland of the coastal features as designated by the CRMC. The coastal zone in Massachusetts consists of all areas inland of coastal features up to the first major transportation route plus 100 feet, as designated by the Massachusetts CZMA.

While portions of the NEC fall into the coastal zone in all three states, only in Connecticut are project facilities and bridges located in the coastal zone. These include the New London Substation site, all of the paralleling station sites in Connecticut (with the exception of Madison), and the Millstone Road (West) Bridge. Of these facilities, the Leetes Island and Noank paralleling stations are designated as coastal flood hazard areas, and the remainder of the sites are classified as shorelands, which is the coastal zone designation for uplands. In addition, all five moveable bridges are located in the coastal zone, and are in coastal flood hazard areas as they are sited at rivers. The Shaw's Cove, Thames River, and Mystic River bridges are also located partially in developed shorefront areas, and the latter two are also located partially in areas classified as estuarine embayment. The Connecticut River Bridge is located partially in estuarine embayment, and a portion of the Niantic River Bridge area is classified as beaches and dunes.

Other Protected Areas. There are many protected parcels of land located in the NEC study area. These include conservation areas, land trusts, state parks, dedicated open spaces, local parks, Areas of Critical Environmental Concern (ACEC), and other protected areas. The major parcels and their locations are listed below:

- Salt Meadow National Wildlife Refuge, Westbrook, CT
- Rocky Neck State Park, East Lyme, CT
- Haley Farm State Park, Groton, CT
- Bluff Point State Park, Groton, CT
- Mashantucket Land Trust, Stonington, CT
- Burlingame State Park, Westerly and Charlestown, RI
- Great Swamp Management Area, Richmond, Charlestown, and South Kingstown, RI
- Goddard State Park, East Greenwich, RI
- Canoe River ACEC, Mansfield, Foxboro, and Sharon, MA
- Fowl Meadow and Ponkapoag Bog ACEC and Neponset River Reservation, Canton, Dedham, and Boston, MA

3.1.2(e) Existing Land Use near Express Stations

The study corridor currently contains an operating intercity railroad. No major alignment, right-of-way, or infrastructure modifications are included in the Proposed Action. Therefore, secondary development stimulated by the project would be confined to those that might occur in the vicinity of the five express passenger stations within the corridor because the majority of the ridership created by the electrification would pass through these

areas. The following paragraphs describe the areas where there is potential for land use changes resulting from the implementation of this project.

South Station. Boston's major intermodal transportation hub is also a major business center. All of the land surrounding the station is developed or unavailable, precluding new development.

Back Bay Station. The second Boston railroad station is also located in a developed area with little remaining vacant land. Some commercial opportunities do exist, however. Redevelopment is possible on two parcels bordered by Clarendon Street, Columbus Avenue, and the former Greyhound bus station on Saint James Street. Currently these parcels are used for ground-level parking.

Route 128 Station. This suburban station is surrounded by considerable amounts of vacant land. Some potentially developable areas exist in Westwood, MA, although large portions of these areas are protected from development by the Fowl Meadow ACEC or are undevelopable because of wetlands. Most of this area is already regulated by a strict water resource protection district, but an industrial park is located south of the station off University Avenue. One parcel and a few of the existing buildings within the park are vacant and have the potential to be commercially developed. No immediate opportunities exist in Dedham because those areas not protected are zoned for residential development. In the future, much or all of the area may be included within a water resource protection district when new town wells are set up nearby. Also, the Neponset Initiative, which was recently adopted, would put any development in this area under a higher level of scrutiny.

Providence Station. This station is located within a highly urbanized area which contains many commercial services. Nevertheless, some expansion of commercial services is possible. The Foundry, located south of the station between I-95, Promenade Street, West River, and Bath Street, is a former manufacturing complex which is a candidate for a regional mall development. South of the station, at the present site of the University of Rhode Island's Providence Campus (Hayes Street), Providence Place is a potential site for a retail development. Finally, a wholesale food and produce center could be developed between I-95, Killingly Street, and Dean Street, south of the station.

New Haven Station. Union Station in New Haven is located in close proximity to some vacant commercial land parcels. Some commercial development proposals are currently being considered, including the Ninth Square Project, the Downtown South Project, and the Air Rights Super Regional Mall.

3.2 SOCIOECONOMICS

The NEC passes through a wide range of socioeconomic areas, from densely populated to undeveloped areas. The Proposed Action and a number of the No-Build Alternative scenarios have the potential to increase noise and vibration, electromagnetic fields, and visual intrusions, and to generate secondary development. Consequently, impacts upon land values, tax revenues, employment, income, tourism, and minority and low income populations may occur. This section discusses existing land values, tax revenues, employment levels, income levels, the contribution made by tourism to the local economy, and minority and low income populations. Socioeconomic issues related to the five moveable bridges in Connecticut and freight rail along the NEC are also discussed.

3.2.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.2.1(a) Federal Regulations

Although not addressed in specific Federal regulations, socioeconomic impacts are discussed generally in NEPA. NEPA contains a goal addressing fulfillment of the social and economic requirements of present and future generations of Americans, and the balancing between population and resource use which will permit higher standards of living and a wide sharing of life's amenities.

Environmental Justice: Presidential Executive Order 12898 of February 11, 1994, requires Federal agencies to insure their programs or Federally funded programs they oversee do not discriminate against minority or low income populations.

3.2.1(b) State Regulations

Connecticut. Socioeconomics are not specifically addressed in Connecticut state regulations.

Rhode Island. Socioeconomics are not specifically addressed in Rhode Island state regulations.

Massachusetts. Socioeconomics are not specifically addressed in the Massachusetts state regulations. However, MEPA requires that in the decision-making process, state agencies balance critical environmental, economic, and social objectives.

3.2.2 Affected Environment

3.2.2(a) Land Values and Tax Revenues

Real estate taxes are assessed for each property in a community and are based on the assessed value of the land plus any structures located on it. Real estate assessments are not performed yearly and therefore do not always reflect current values. However, they prove useful in economic analyses. The state totals for real estate values and tax revenues in communities through which the NEC passes are shown below:

State	Real Estate Value	Real Estate Tax Revenues
Connecticut	$17,401,293,860	$172,432,883
Rhode Island	$16,771,759,740	$372,748,978
Massachusetts	$37,743,520,993	$639,312,200
TOTAL	$71,916,574,593	$1,184,494,061

Sources: Municipal Assessors and Tax Collectors Offices, 1992

3.2.2(b) Employment

The Proposed Action may have an effect on employment within the project corridor during both construction and operation of service. Permanent and temporary employment opportunities would be created; community employment characteristics would play a part in the ability of the communities within the study area to supply workers. Table 3.2-1 shows the distribution of employment by industrial sector for each of the states within the project corridor.

3.2.2(c) Income

Median household income is a general measure of the income characteristics of the population. The median income range for each state is shown below:

State	Lowest Municipal Median Income	Highest Municipal Median Income
Connecticut	$25,811	$61,871
Rhode Island	$18,617	$50,896
Massachusetts	$29,180	$61,692

Source: U.S. Census Bureau, 1990

3.2.2(d) Tourism

Tourism generates personal income, tax revenues, and employment opportunities. The physical attractiveness of an area is a key factor in its ability to lure tourists. Any significant reduction in aesthetics could affect both the business and tax revenues, as well as the employment and individual income of the area's population. On the other hand, improved transportation facilities and access could increase the area's appeal to tourists. Tourism usually generates a demand for goods and services from the following industries: public transportation, automobile transportation, lodging, food service, entertainment, recreation, and general retail trade. Revenue for travel and tourism for the counties in each state through which the NEC passes is shown below:

State	Tourism Revenue in NEC Counties ($ millions)
Connecticut	$ 553
Rhode Island	$ 878
Massachusetts	$ 125
TOTAL	$1,556

Sources: State and Local Tourism Offices, 1992

3.2.2(e) Minority and Low Income Populations

A review of the facility sites shows that eight of the 25 facilities would be located near populated areas: the New London, Warwick, and Roxbury substations, and the Grove Beach, Noank, Elmwood, Providence, and Readville paralleling stations.

Table 3.2-2 lists census tract information for each of these populated sites. Of the eight sites, two would be located in minority or low income areas. As indicated, only the proposed Roxbury Crossing substation would be situated in a minority area (more than 50 percent non-white population). Further, the Providence paralleling station site, with a median household income of $9,551, would be the only site located in an area below the Federal poverty level of $14,808.[2]

3.2.2(f) Freight Rail

Overview. As the provider of all Shore Line freight train services in Rhode Island and Connecticut, the Providence & Worcester Railroad (P&W) provides service to 41 businesses which directly employ over 21,000 workers. These firms generate in excess of $594,300,000 in direct wages annually. In addition, jobs directly generated by these firms generate an additional 49,000 indirect jobs, paying over $1,200,000,000 in annual wages. The annual freight shipped by these firms includes more than 455,000 tons of aggregate; 114,000 tons of chemicals; and 7,000,000 board feet of wood products. P&W's payments to Amtrak for use of the NEC main line in 1993 totaled $196,000.

Freight Services in Connecticut. P&W presently operates four local freight trains over portions of the NEC Shore Line in Connecticut.[3] These freight trains provide service to 18 Connecticut customers at 11 locations along the Shore Line. P&W traffic data indicate that these customers generated 4,156 cars inbound and 3,587 cars outbound at Shore Line locations in 1993.[4] A substantial number of these inbound and outbound car counts represent both an origin and a destination along the Shore Line as the product handled (aggregate) lends itself to railroad transportation for short hauls. Thus, a simple addition of the inbound and outbound car counts (7,743) involves an overstatement of the volume of revenue cars handled insofar as Shore Line customer locations are concerned.

Other than the aggregate traffic, freight traffic on the NEC in Connecticut has been in a period of decline. Over the last 10 years, the number of carloads shipped (excluding aggregate carloads) has declined by approximately one-third.

Companies served by P&W's Connecticut operations occupy 17 manufacturing, transportation, and mining standard industry classifications. These firms employ 15,833 workers paying in excess of $441,000,000 in direct wages annually. In addition, jobs generated indirectly by these firms employ over 39,000 workers, paying $972,000,000 in annual wages.[5]

Freight Services in Rhode Island. P&W now operates two local freight trains along the Shore Line Route within Rhode Island.[6] Both locals originate and terminate at Valley Falls Yard which is located approximately 1 mile north of Boston Switch on the railroad's main line between Worcester and Central Falls. These local freight trains provide service to 23 Rhode Island customers at 10 locations. In 1993, these customers generated 3,695 revenue carloads of freight business. Inbound commodity volumes dominate the market as only 215 carloads originate at these customer locations while the balance of 3,480 cars are inbound moves.[7] Over the last 10 years, carloads of freight shipped over the NEC in Rhode Island have been relatively flat - a 4.3 percent increase over the 10-year period.

Companies served by P&W's Rhode Island operations occupy 15 manufacturing, transportation, and agricultural standard industry classifications. These firms directly employ 5,167 workers, paying in excess of $148,900,000 in direct wages annually. In addition, jobs generated indirectly by these firms employ over 10,000 workers, paying $260,000,000 in annual wages.[8]

Freight Services in Massachusetts. Conrail continues to operate freight trains along the Shore Line in Massachusetts as successor to the Penn Central and New Haven Railroads. Conrail Shore Line freight trains serve customer locations both along the NEC and at other locations east of the Shore Line such as Taunton, Quincy, Braintree, Brockton, Middleboro, Fall River, New Bedford, and the Cape Cod region.

Conrail presently operates three daily freight trains along the Massachusetts segment of the NEC between Readville (Boston) at MP 219 and South Attleboro at MP 192. No local freight services are operated between Readville and Back Bay Station at MP 228. In addition, Conrail operates a local freight train between Readville and the Stoughton Branch line (MP 214) on Tuesdays and Thursdays only.

The 7-mile segment of the NEC between Mansfield and Attleboro carries the highest freight traffic volume for the entire NEC between New Haven and Boston, with annual volumes ranging from 1-3 million gross tons. Much of this freight traffic represents shipments with origins and destinations within southeastern Massachusetts east of Attleboro.

3.2.2(g) Marine Industry

The boating industry, while not the largest industry in Connecticut, makes a large and significant contribution to the economy of the State of Connecticut. As estimated by one marine association, the total economic impact of this industry is approximately $1.6 billion.[9] The State of Connecticut receives approximately $62 million annually in taxes collected on the sale of boats, equipment, services, registration fees, and boating fuel.[10]

Records for the year 1992 from the State of Connecticut Department of Motor Vehicles show approximately 100,877 vessels registered in the entire state. Of that total, 89 percent are less than 26 feet in length while the remaining 11 percent of vessels range from 26 to 100 feet. Shoreline communities south of Interstate 95 account for roughly one-third of all boat registrations; the remaining two-thirds are registered in inland towns. Registration in inland towns likely denotes the residence of the boat owner and not the boating season location of the boat.

During the spring of 1994, telephone surveys were conducted with representatives of a large group of marinas and marine-related businesses in the areas surrounding the five moveable bridges between New Haven and the CT-RI border (see Section 3.9.2 for a detailed discussion of the moveable bridges). The telephone survey requested facility as well as economic data. Facility data requests ranged from numbers of slips, moorings, and winter storage to distance from the railroad bridge in question. Economic data requests attempted to obtain the

rental costs of slips, moorings, etc., as well as the aggregate dollar volume from related businesses, i.e., restaurants located on the premises, gas sales, repair volume, etc.

Field interviews were also conducted with four harbormasters located at four of the five moveable bridges. The harbormasters confirmed much of the data being provided by the marina owners/managers, particularly relating to the marine environment in and around the bridges, and in the difficulty in maintaining clear distances and course headings in less than ideal weather conditions while waiting for a railroad bridge to open.

The results of these surveys are summarized in Table 3.2-3.

3.3 HISTORIC RESOURCES

This section provides an inventory of historic resources along the study corridor. Historic resources are those buildings, districts, structures, objects, and sites that are listed on or eligible for listing on the National Register of Historic Places (National Register).

3.3.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.3.1(a) Federal Regulations

National Historic Preservation Act (NHPA) of 1966, (16 USC 470): Section 106 of this statute provides the basis for a review process that requires federal agencies to afford the Advisory Council on Historic Preservation an opportunity to comment on actions that may affect properties listed or eligible for listing on the National Register. Section 106 directs the Secretary of the Interior to maintain a National Register and establishes a State Historic Preservation Office (SHPO) within each state to carry out project review under the statute. The procedure for meeting Section 106 requirements is defined in regulations of the Advisory Council, "Protection of Historic Properties," 36 CFR Part 800.

Section 4(f) Department of Transportation Act of 1966 (49 USC 303(c)): See Section 3.1.1.

Executive Order No. 11593 "Protection and Enhancement of the Cultural Environment" (3 CFR 154, 1971) (reprinted in 16 USC 470): This order directs Federal agencies to take a leadership role in preserving, restoring, and maintaining the historic and cultural environment of the Nation. Federal agencies must locate, inventory, and nominate to the National Register of Historic Places all historic properties under their jurisdiction or control. This order was codified when Section 110 was added to the NHPA in 1980.

Historic Sites Act of 1935 (16 USC 461-467): This act mandated the National Park Service to be the lead Federal agency in historic preservation efforts. It also established three Federal programs: the Historic American Building Survey (HABS), the Historic American Engineering Record (HAER), and the National Survey of Historic Sites and Buildings (Landmarks).

Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001-13): This act provides for the protection of Native American graves and regulates the intentional removal of Native American human remains and associated grave objects. It also defines ownership, sets standards for repatriation and actions to be taken in case of inadvertent discovery. It applies to Federal and tribal lands. To date no implementing regulations have been published.

National Environmental Policy Act 1969 (42 USC 4321-4347): Under NEPA, all agencies of the Federal government have to consider an interdisciplinary approach that insures the integrated use of the natural and social sciences and the environmental design arts in planning any project that may have an impact on the environment. This is widely interpreted as including historic properties.

Archaeological Resources Protection Act of 1979 (16 USC 470aa-470ll): The Archaeological Resources Protection Act (ARPA) allows for protection of archaeological resources and sites which are on public and Native American lands, and means to foster communication between government, professional archaeologists, and private individuals. Under the Act, these resources must be at least 100 years old to be treated as archaeological resources. Section 470cc deals with permitting individuals to excavate on public or Native American lands to remove archaeological resources. ARPA also addresses the confidentiality of information relating to the nature and location of archaeological resources.

Archaeological and Historic Preservation Act of 1974 (16 USC 469-469c): This act allows for the appropriate Federal actions to be taken for the preservation of significant archaeological data when any alteration of the terrain is caused as a result of any Federally funded or licensed undertaking. This specifically includes an identification stage to locate any previously unknown resources.

Antiquities Act of 1906 (16 USC 431-433): This act formed a basis for modern preservation legislation. It authorized the President to designate as National Monuments historic resources of national significance located on Federally owned or controlled land.

3.3.1(b) State Regulations

Connecticut.
Connecticut General Statutes Section 10-321 et seq.: This statute outlines the tasks of the Connecticut Historical Commission (CHC) including the identification, investigation, and preservation of Connecticut's historic, architectural, and archaeological resources and the issuance of standards and guidelines to assist cities and towns in their preservation activities. The CHC serves as the SHPO for Connecticut.

Rhode Island.
Rhode Island Historic Preservation Act of 1968 (RIGL 42-45): This Act directs the Historical Preservation Commission (RIHPC), among other tasks, to advise other state agencies as to the preservation of historic, architectural, and archaeological resources during any state undertakings; to conduct a statewide survey of historic properties; to maintain a state register of historic places; and to develop a historic preservation plan. The RIHPC also serves as the SHPO for Rhode Island.

Massachusetts.
Massachusetts General Law (MGL), Chapter 9, Sections 26-27c: This law, which established the Massachusetts Historical Commission (MHC) and the Office of the State Archaeologist and their respective duties, also mandates the MHC to administer the Federal preservation program as the SHPO. Implementing regulations are found in 950 CMR 70 and 950 CMR 71.

Chapter 254 of the Acts of 1988: This law clarifies the historic review process administered by the MHC and provides for review of an entire project, not just the portion of the project which requires state funding or licensing.

Massachusetts Environmental Policy Act (MEPA), Chapter 30 as amended by Chapter 947 of the Acts of 1977: MEPA requires evaluation of projects to assess their impacts on the natural and human environments, including historical and archaeological sites and structures, as such, the MHC is a participating review agency and can comment on the likelihood of a project to contain archaeological sites and/or historic structures.

3.3.2 Affected Environment

Tables 3.3-1 (Connecticut), 3.3-2 (Rhode Island), and 3.3-3 (Massachusetts) provide an inventory of historic resources listed or eligible for listing on the National Register, with the location and the National Register status of each. Historic resources within sight of the NEC ROW or the electrification facilities were considered within the zone of potential impact for the project. All relevant sources of pre-existing information on historic properties, including National Register listings, determinations of National Register eligibility, local historic

districts, state surveys of historic resources by town, state inventories of historic highway bridges, and historic resource reports prepared in 1978 for the PEIS were consulted. The inventory identifies 37 historic railroad bridges, 10 historic roadway or pedestrian bridges, 131 individual historic properties, and 47 historic districts, listed or eligible for listing on the National Register.

3.4 NOISE AND VIBRATION

The primary source of noise associated with the existing rail facility is the locomotive-hauled train operations. Potential additional secondary sources of noise include motor vehicle traffic at train stations, fixed facility noise (e.g., substations), and noise from construction. For vibration, the primary source is the interaction of the train wheels on the tracks. Potential secondary sources include vibration from the construction of facility sites and bridges. The predominant noise- and vibration-sensitive land uses are residential; additional sensitive receptors include schools, churches, and other institutional buildings.

The following sections provide a listing of the relevant Federal and state regulations; and a description of the existing noise and vibration environment, including measurements at sensitive receptor sites.

3.4.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.4.1(a) Federal Regulations

There are no Federal noise and vibration standards directly applicable to high-speed rail. However, the following Federal regulations have been applied as guidelines for the project. The regulations listed below also include thresholds for increased traffic, fixed facility noise, and noise from construction.

Environmental Protection Agency Railroad Noise Emission Standards (40 CFR Part 201) and FRA Railroad Noise Emission Compliance Regulations (49 CFR Part 210): Pursuant to Section 16 of the Noise Control Act of 1972 (42 USC 4916), the Environmental Protection Agency (EPA) has issued noise emission standards for specific types of railroad equipment. FRA has adopted these regulations for the purpose of enforcement. The standards provide specific noise limits for stationary and moving locomotives (except gas turbine locomotives), moving railroad cars, active retarders, car coupling, and locomotive load cell test stands in terms of A-weighted sound level, or decibels (dBA), at a specified measurement location. These regulations are preemptive; thus state and local governments cannot set more stringent limits for railroad equipment than the Federal regulations require.

HUD Standards (24 CFR Part 51): The U.S. Department of Housing and Urban Development (HUD) has developed noise standards for the acceptability of sites for projects that it funds. The purpose of the standards is to encourage the development of land uses which are compatible with the surrounding noise environment. The criteria, expressed in terms of L_{dn}, define levels not exceeding 65 dBA as "acceptable," levels above 65 dBA but not above 75 dBA as "normally unacceptable," and levels above 75 dBA as "unacceptable" for residential areas.

Federal Transit Administration Guidelines: Noise impact criteria for transit projects are included in Urban Mass Transit Administration Circular C 5620.1 issued by the Federal Transit Administration (FTA), formerly the Urban Mass Transit Administration. The criteria are based on noise increase in terms of either L_{eq} or L_{dn}. The criteria consider noise increases of 3 dBA or less to be "generally not significant," noise increases of 4 or 5 dBA to be "possibly significant," and noise increases of more than 5 dBA to be "generally significant."

FTA is currently developing a *Guidance Manual for Transit Noise and Vibration Impact Assessment* which includes new criteria for noise and vibration impact evaluation. These are described in Section 4.4 of this document. For noise, the criteria limit the noise increase due to the project, based on the existing ambient noise level, in terms of L_{eq} or L_{dn}. These criteria reflect an equivalent increase in noise annoyance depending on the existing noise, allowing less of an increase at locations where existing noise levels are higher. The proposed FTA vibration criteria include impact thresholds based on land use and event frequency, in terms of the root-mean-square (rms) ground vibration velocity level (V_{dB}, in dB re 1 micro-in/sec).

Bureau of Mines Guidelines: Researchers at the U.S. Bureau of Mines (BOM) have identified a ground vibration peak particle velocity of 2.0 inches per second (in/sec) as a safe blasting limit to avoid major damage to residential structures, but recommend lower levels to minimize complaints (Nicholls, 1971). They have also identified a ground vibration peak particle velocity of 0.5 in/sec as the approximate threshold for minor cosmetic damage to buildings.

3.4.1(b) State Regulations

Connecticut. The State of Connecticut Noise Control Regulations contain specific noise limits based on source and receiver land use category as well as time of day of exposure to the noise. The regulations generally apply to fixed sources such as electric substation facilities. The most stringent limits relating to substation noise govern noise transmitted from industrial land to residential property. For this case, the applicable limits at the residential property line are 61 dBA during the daytime (7:00 AM to 10:00 PM) and 51 dBA at night (10:00 PM to 7:00 AM). These levels are to be reduced by 5 dBA if the intruding noise has audible, discrete tones (e.g., transformer noise). The regulations also specify that if the background noise is measured to exceed the standards, then the noise limit shall be set at a level 5 dBA above the background level. The regulations define background noise in statistical terms as the noise level exceeded 90 percent of the time (denoted as L_{90}). Connecticut has no vibration control regulations.

Rhode Island. Rhode Island has no specific regulations pertaining to fixed sources such as electric substation facilities.

Massachusetts. Specific guidelines for enforcing the Massachusetts Noise Regulation (310 CMR 7.10) have been developed by the Department of Environmental Protection (DEP) Division of Air Quality Control (DAQC). The guidelines, contained in DAQC Policy 90-001, state that a source of sound will be considered to be violating the DEP's noise regulation if the source (1) increases the broadband sound level by more than 10 dBA above ambient (L_{90}), or (2) produces a "pure tone" condition (e.g., from transformers). For guidelines relevant to ground vibration, blasting limits are included in Board of Fire Prevention Regulations (527 CMR 13.11). These limits are essentially equivalent to a peak particle velocity of 1.9 in/sec, which is slightly more conservative than the U.S. BOM criterion of 2.0 in/sec for structural damage.

3.4.2 Affected Environment

The existing noise and vibration environment along the NEC, between New Haven and Boston, is dominated by diesel locomotive-hauled railroad train operations. Primarily intercity and commuter passenger trains, this traffic also includes a limited number of freight operations. Secondary sources of noise along the corridor include motor vehicle traffic on nearby roadways, aircraft overflights in some areas, and general community activities. Other than train operations, there are no significant sources of ground-borne vibration along the corridor.

The major sources of existing train noise along the corridor are: (1) the diesel locomotive engines; (2) the rolling interaction of the train wheels on the track rails; and (3) the locomotive horns that are sounded near the few remaining rail-highway grade crossings. The major source of existing ground-borne vibration from trains is the rolling interaction of the rail vehicle wheels on the rails. Although the track features continuous welded rail (CWR) along most of the corridor, there is increased noise and vibration from wheel/rail impacts where there are jointed rails. These locations are primarily where there are special track configurations such as switches and crossovers.

The predominant noise- and vibration-sensitive land use along the corridor is residential. Additional sensitive receptors include schools, churches, and other institutional buildings.

3.4.2(a) Measures of Noise and Vibration

Noise Descriptors. The most commonly used measure of noise is the A-weighted sound level, expressed as dBA. The A-weighted sound level is a single-number measure of sound intensity with weighted frequency characteristics

that correspond to human subjective response to noise. It is widely accepted by acousticians as a proper unit for describing environmental noise.

Because environmental noise fluctuates from moment to moment, it is common practice to condense all this information into a single number, called the "equivalent" or "energy-average" sound level (L_{eq}). Because many surveys show that the L_{eq} properly predicts annoyance, this descriptor is commonly used for noise impact assessment. L_{eq} can be thought of as the steady sound level that represents the same sound energy as the varying sound levels over a specified time period. Commonly used equivalent noise descriptors are the L_{eq}(h), measured over a 1-hour period, and the L_{eq}(24), measured over a 24-hour period.

One of the most widely accepted measures of cumulative noise exposure in residential areas is the Day-Night Sound Level, abbreviated as L_{dn}. The L_{dn} is the A-weighted equivalent sound level for a 24-hour period with an additional 10-decibel weighting imposed on noise that occurs during the nighttime hours (between 10:00 PM and 7:00 AM).

Environmental noise can also be viewed on a statistical basis using percentile sound levels, L_n, which refer to the sound level exceeded "n" percent of the time. For example, the sound level exceeded 90 percent of the time (L_{90}) is often considered to represent the "background" noise in a community. Similarly, the sound level exceeded 33 percent of the time (L_{33}) is often used to approximate the L_{eq} from traffic in the absence of sporadic events such as aircraft overflights and train passages.

Vibration Descriptors. Vibration is an oscillatory motion of an object about some equilibrium position which can be described in terms of displacement, velocity, or acceleration. The response of humans, buildings, and equipment to vibration is more accurately described using velocity or acceleration. Because vibration velocity amplitude within the low frequency range is of most concern for environmental vibration (roughly 5 to 100 Hz), vibration velocity is used in this analysis to describe ground-borne vibration from train operations.

The descriptor used in this analysis for the assessment of ground-borne vibration is the rms vibration velocity level, V_{dB}, expressed in decibels relative to 1 micro-in/sec. The rms amplitude is defined as the average of the squared amplitude of the signal, and is typically evaluated over a 1-second period of time.

3.4.2(b) Existing Noise and Vibration Measurements

Measurements were conducted at 11 noise- and vibration-sensitive sites distributed along the corridor between New Haven and Boston. The sites were chosen to be representative of a range of community environments (urban, suburban, or rural) and types of train operations (consists, schedules, and speeds). The 11 sites characterize the full range of combinations of community environment and train operations that are experienced over the entire 156-mile corridor and therefore fully illustrate the existing and future noise impacts of the Proposed Action. (A summary of the existing noise measurement results is shown in Table 3.4-1.)

The noise measurement results indicate L_{dn} ranging from 68 to 77 dBA at the monitoring sites located 25 to 105 feet from the near track. The L_{eq}(24) were 4 to 7 dBA lower than the L_{dn}, and the maximum L_{eq}(h) ranged from 67 to 74 dBA. These levels were dominated by trains, with maximum noise levels (L_{max}) ranging from 72 to 114 dBA, with the highest levels caused by train horns. Minimum background noise levels (L_{90}) ranged from 25 to 47 dBA.

The train vibration measurement results shown in Table 3.4-2 indicate maximum vertical ground vibration velocity levels (V_{dB}) of 60 to 95 dB at the monitoring sites, located 25 to 119 feet from the near track. These levels range from just below the approximate threshold for human perception of vibration to the approximate threshold for cosmetic damage to historic or fragile buildings.

3.5 ELECTROMAGNETIC FIELDS AND INTERFERENCE

Electromagnetic fields (EMF) are present whenever electricity is used or transported and, therefore, are generated by electric-powered trains and facilities. The electromagnetic fields generated by the Proposed Action would have frequencies at the extremely low frequency (ELF) end of the electromagnetic spectrum. Recent public attention has prompted additional evaluation and research to consider the possibility that time-fluctuating ELF/EMF poses a health risk with long-term exposure. This area of environmental review focuses on the potential health effects of EMFs associated with the electrification of the NEC, and also considers the effects of the system on communications systems in the form of electromagnetic interference (EMI).

3.5.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.5.1(a) Federal Regulations

No Federal standards exist for either environmental or occupational health and safety limits to ELF electric and magnetic field exposure. Regulations by the Federal Communications Commission (FCC) do exist for the field strengths of "unintentional radiators" of electromagnetic fields in the radio frequency range, to prevent radio interference.

3.5.1(b) State Regulations

Connecticut, Rhode Island, and Massachusetts do not have regulations that specifically limit electric or magnetic fields from power lines and facilities, or equipment.

3.5.2 Affected Environment

This section describes both the types and locations of persons that may be potentially exposed to higher than background levels of EMFs as a result of the Proposed Action; the existing background EMF in the NEC area; EMF effects on fish; and the experience of several key agencies with EMI along the electrified portion of the NEC south of New Haven.

3.5.2(a) Categories of Persons Potentially Exposed to EMF Emissions

The following persons have the potential to be exposed to EMF emissions from the Proposed Action:

- residents (adult and child subcategories) in the vicinity of the ROW and utility tie-lines
- persons working in the vicinity of the ROW
- persons using recreational areas or other public facilities in the vicinity of the ROW
- rail passengers and employees

EMF intensity decreases with increased distance from its source. Based upon field measurements of existing electrified tracks and power supply systems presented in Technical Study 5, Vol. III, of the DEIS/R, EMF intensities from the electrical systems are projected to drop to background levels approximately 150 feet from their sources. In order to estimate populations and the EMF intensities to which these populations are exposed, three equally spaced zones along the length of the ROW extending outward to a distance of 150 feet from the source are identified:

- Zone 1: from the track edge (or boundary of an EMF-generating source) to a distance of 50 feet from the edge of the tracks (or boundary)
- Zone 2: from 50 feet to 100 feet
- Zone 3: from 100 feet to 150 feet

For EMF sources other than the catenary that provides power to the trains (such as substations or utility feed lines) distances were measured from the boundary of the facility or equipment closest to the population exposed.

Populations beyond 150 feet of the EMF source are not considered to be affected since no incremental EMF exposure over the existing background levels is expected beyond this distance.

Magnetic field exposure levels were estimated for various locations away from an electrified track in Section 5.5.7, Volume III of the DEIS/R. The sources identified were the catenary, substations, and utility tie lines. Catenary (wayside) average EMF exposure (mG) was estimated to be 1.5 to 9.3, 0.4 to 1.5, and 0.2 to 0.4 for 0 to 50, 50 to 100, and 100 to 150 feet respectively. Substation average EMF exposure (mG) was estimated to be 2.2 to 13.5, 0.5 to 2.2, and 0.2 to 0.5 for 0 to 50, 50 to 100, and 100 to 150 feet respectively. Tie line average EMF exposure (mG) was estimated to be 5.5 to 13.0, 3.0 to 5.5, and 2.0 to 3.0 for 0 to 50, 50 to 100, and 100 to 150 feet respectively. The centerline of the tracks typically coincides with the centerline of the ROW; thus, a buffer zone exists between the edge of the tracks and the edge of the ROW. The typical ROW width is 80 to 100 feet, and a dual track occupies approximately 20 feet (outside rail to outside rail). This results in a separation of 30 feet or more between the edge of tracks and the abutting properties. Therefore, when assessing general population exposure, only populations within 20 feet of the edge of the ROW have been considered to be within Zone 1.

There are several categories of population that would potentially be exposed to EMF from the electrification project. These populations differ by location and activity. Although there is insufficient scientific evidence to relate a particular combination of EMF exposure level and duration of exposure to a health effect, it is of interest to distinguish between long-term exposures, as would occur in a residential location along the ROW, and short-term or occasional exposures, as would occur for passengers on the trains. There is also a distinction between voluntary and involuntary exposures, because of the fact that the train passenger (voluntary exposure) has alternative modes of travel and chooses to ride the train rather than use one of the alternatives. In addition, the EPA is also concerned that potential impacts from electromagnetic fields do not have a disproportionate adverse effect on minority populations.[11]

Therefore, three broad categories of exposure duration are defined: environmental, occupational, and occasional. Environmental exposure refers to exposures resulting from occupancy of a residence and of the three exposures is the longest in duration. Occupational exposures are those that result from working along the ROW or on electrified trains and are the second-longest in duration. Occasional exposures are those exposures that arise from short-term occupancy of one of the defined exposure zones, such as passengers on platforms or in trains. The types of populations analyzed, their category of exposure, and their physical attributes are summarized in Tables 3.5-1 and 3.5-2.

3.5.2(b) Background EMF

People have been exposed to manmade EMF emissions over the past 100 years. Today, virtually every person is regularly exposed to EMF of a variety of frequencies and intensities, in virtually any environment where people live and work. The time-averaged magnetic field level associated with the average home is typically less than 4 milligauss (mG). Other ranges of potential exposure near specific home, office, and environmental sources include:

• electrical appliances	5 to 3,000 mG
• residential distribution lines	1 to 10 mG
• electric blankets	5 to 13 mG
• under high-voltage transmission lines	12 to 200 mG

Source: Roy F. Weston, Inc.

Urban background EMF intensities were measured in the street during a 6-mile drive through the city of Providence, RI, and its outskirts to characterize the existing streetside EMF environment. The following conclusions were drawn from the data:

- The recorded EMF ranges from 0 to 26 mG.
- The highest sustained readings are in the range of 10 mG; readings higher than 10 mG occur as instantaneous "spikes," indicative of a narrow source such as a power line.
- The average of the data appears to be about 4 mG.

It would appear that through normal daily activities in a relatively urban area a person would be exposed regularly to EMF averaging about 3 to 4 mG and within a range of 1 to 7 mG. Persons may be exposed to EMF up to 10 mG on a brief basis and would be exposed to EMF of a considerably higher level if operating an electric device (up to 3,000 mG) or passing under a power line (up to 200 mG).

Additional sampling efforts were taken in two relatively rural, non-electrified areas along the ROW. These two locations are Stony Creek in Branford, CT, and Rocky Neck State Park in East Lyme, CT. Measurements were taken of peak EMF field strengths at three distances from the outside rail on each side, with the following results:

Location	**Maximum Magnetic Field Intensity (mG)**
Stony Creek	
15 feet from rail	0.390
60 feet from rail	0.032
150 feet from rail	0.025
Rocky Neck State Park	
15 feet from rail	1.430
60 feet from rail	0.026
150 feet from rail	0.005

Source: Roy F. Weston, Inc.

These measurements indicate a lower level of magnetic field intensity in rural areas than in urban areas (as described by the data from Providence, RI).

An ELF/EMF additional sampling effort was undertaken at and around the existing MBTA substation located directly opposite the possible site of the Roxbury Crossing substation. The MBTA has different electrotechnologies than the Proposed Action (i.e., the third rail 600V-DC, LRT with catenary trolley lines). The magnetic field values directly around the MBTA substation range from 0.7 to 1.9 mG, and are generally between 0.4 mG and 1.1 mG elsewhere, except for two locations which are under utility power distribution lines (1.9 to 2.0 mG); another location which is under a power distribution line and over an electric service line (4.8 mG); and another location whose EMF source is unknown but may be related to an underground electric conduit at the north corner of Halleck and Station Streets (3.1 mG). The methodology and detailed results of this sampling effort are presented in Chapter 5 of Volume II of this FEIS/R.

3.6 ENERGY

This section describes the existing energy use of the Amtrak operation between Boston and New Haven. The affected environment with respect to energy assessment is the current consumption of fuel by diesel locomotives.

3.6.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.6.1(a) Federal Regulations

The Federal Energy Regulatory Commission (FERC), U.S. Department of Energy (DOE), and EPA have no specific energy regulations or policies that apply to this project. However, the CEQ regulations for

implementation of NEPA (40 CFR 1500 et seq.) contain two requirements that relate to energy use. The first is a requirement to include within an EIS a discussion of the energy requirements and conservation potential of various alternatives and mitigation measures. The second is a requirement for an EIS to address depletion of natural resources. Likewise, DOT Order 5610.1C contains a fairly general requirement for addressing energy impacts in an EIS. Specifically, this regulation states that "the statement should reflect consideration of whether the project or program will have any effect on either the production or consumption of energy and other natural resources, and discuss such effects if they are significant." Section 14 (10) of the FRA Procedures require that an EIS include an analysis of any irreversible or irretrievable commitments of energy resources associated with each alternative, especially those that impact on petroleum or natural gas use.

3.6.1(b) State Regulations

Connecticut and Rhode Island. No Connecticut or Rhode Island regulations have been identified which would impose specific requirements on the energy analyses conducted.

Massachusetts. Massachusetts requirements for energy analysis are for comparative analyses or quantification of energy use; no regulatory thresholds have been established for energy use.

3.6.2 Affected Environment

The analysis in the DEIS/R of the energy consumption of the current Amtrak diesel train service was based on a schedule of 139 one-way trips between Boston and New Haven each week. The most current information available from Amtrak at the time of publication of the FEIS/R indicates a slightly different schedule from that assumed in the DEIS/R.[12] Accordingly, the analysis of energy consumption associated with the current diesel train service has been recalculated.

According to Amtrak, the current schedule is 20 diesel trains per day, comprised of the following:

- Four (4) one-way express trips per day with one locomotive and four cars (express service)
- Ten (10) one-way conventional trips per day with one locomotive and six cars (conventional service)
- Six (6) one-way conventional trips per day with two locomotives and ten cars (Fast Mail and Night Owl service)

Amtrak estimates energy consumption as follows:

- 263 gallons per one-way trip for express service
- 297.5 gallons per one-way trip for conventional service
- 510 gallons per one-way trip for Fast Mail or Night Owl service

Using these data, diesel consumption is estimated to be 2,586,755 gallons per year. At 141,000 Btu per gallon of diesel fuel, this represents 364.7 billion Btu per year.

The energy consumption per passenger-mile can serve as a basis of comparison with other transportation options. The estimate of passenger-miles traveled is 182,630,600 passenger-miles per year. Thus, 1,997 Btu per passenger-mile are consumed in the current diesel service.

Another means of comparing consumption among train alternatives is Btu per seat-mile. This eliminates any inconsistencies resulting from passenger loading assumptions. The number of seats per train is estimated as follows:

- 258 seats on an express train
- 413 seats on a conventional train with six cars
- 420 seats on a conventional train with ten cars (some of the cars, such as mailcars, do not seat passengers)

Using the distance from New Haven to Boston (approximately 156 miles), the number of seat-miles is determined to be approximately 1.2 million per day or 437.4 million per year. Based on an energy consumption of 364.7 billion Btu per year, 834 Btu are consumed per seat-mile.

3.7 ARCHAEOLOGY

This section provides an assessment of the prehistoric and historic period archaeological sensitivity of the areas proposed to be used as part of the Proposed Action. These include the sites planned for switching and paralleling stations and substations, utility corridors, and areas where bridges are raised or replaced. The archaeological assessment consisted of documentary research and field survey.

3.7.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.7.1(a) Federal Regulations

National Historic Preservation Act (NHPA) of 1966, as amended (16 USC 470): See Section 3.3.1(a).

Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001-13): See Section 3.3.1(a).

Archaeological Resources Protection Act of 1979 (16 USC 470aa-470mm): See Section 3.3.1(a).

Archaeological and Historic Preservation Act of 1974 (16 USC 469-469c): See Section 3.3.1(a).

Executive Order No. 11593 "Protection and Enhancement of the Cultural Environment" (3 CFR 154, 1971) (reprinted in 16 USC 470): See Section 3.3.1(a).

Historic Sites Act of 1935: See Section 3.3.1(a).

3.7.1(b) State Regulations

Connecticut.

Connecticut Public Act 81-177: Amended the Environmental Policy Act by identifying the Connecticut Historical Commission as a mandated review agency for state-funded projects and cultural resources as important factors in project planning.

Rhode Island.

Rhode Island Historic Preservation Act of 1968 (RIGL 42-45): See Section 3.3.1(b).

Massachusetts.

Massachusetts General Law (MGL), Chapter 9, Sections 26-27c: This general law established the Massachusetts Historical Commission (MHC) and the Office of the State Archaeologist. See Section 3.3.1(c).

Chapter 254 of the Acts of 1988: See Section 3.3.1(b).

Massachusetts Unmarked Burial Law: The unmarked burial law requires individuals and entities who discover an unmarked human burial or skeletal remains to cease any activity upon the site which would deface, alter, destroy or otherwise impair the integrity of the site until the State Archaeologist has conducted a site evaluation.

Massachusetts Underwater Archaeology Act, Chapter 989, Acts of 1973: This act established the Board of Underwater Archaeological Resources to protect and preserve historical, scientific and archaeological information about underwater archaeological resources located within the waters of the Commonwealth.

Massachusetts Environmental Policy Act (MEPA), Chapter 30 as amended by Chapter 947 of the Acts of 1977: See Section 3.3.1(b).

3.7.2 Affected Environment

3.7.2(a) Methods for Assessing Archaeological Sensitivity

Information on previously known or reported archaeological sites was obtained from the site files of the Connecticut Historical Commission (CHC), the Connecticut Office of State Archaeology (COSA), the Rhode Island Historical Preservation Commission (RIHPC), and the Massachusetts Historic Commission (MHC). In addition, the survey team consulted the National Register of Historic Places to identify any National Register-listed sites within or adjacent to project areas, as well as archaeological assessment reports associated with the NECIP PEIS.

In each state, the archaeological survey was conducted according to that state's regulations and coordinated with the SHPO. Although the regulations might differ slightly, the methods and goals of the survey were the same: to assess the site's potential for containing buried cultural remains through documentary research and a field inspection.

Archaeological sensitivity is defined as the likelihood for prehistoric and/or historic cultural resources to be present within the project area. Based on project-specific environmental factors and information on known cultural resources and human land-use patterns, portions of the study corridor were stratified as having a high, moderate, or low potential for prehistoric and/or historic resources. The evaluation of the prehistoric archaeological sensitivity of the project area considered the following information: (1) the presence of known prehistoric sites within or in close proximity to the project area; (2) the level of past ground disturbance in the project area; and (3) the environmental characteristics and available natural resources of the area (see Table 3.7-1). The evaluation of the historic archaeological sensitivity of the project area considered the following information: (1) the inventory of known historic sites and/or districts within or in close proximity to the project area; (2) developmental history, historical demography, and geography; (3) the level of ground disturbance to the project area; and (4) the locational attributes of the project area (see Table 3.7-2).

3.7.2(b) Existing Environment

Archaeological surveys were conducted at 34 areas to be affected by the Proposed Action, including the 25 electrification facility sites and associated utility corridors and seven bridge modification sites. Undisturbed sites that initially were recorded in the DEIS/R as having moderate or high potential, and were reclassified to low archaeological sensitivity after subsurface exploration, are identified below. (Tables 3.7-3 through 3.7-6 provide a brief summary of the archaeological sensitivity of all project sites.)

Substation sites. Of the four substation sites, three appeared to have potential for archaeological sensitivity: Branford, Roxbury Crossing and New London. Subsequent systematic subsurface testing found no intact cultural remains at the Branford site (see Table 3.7-3). Roxbury Crossing and New London feeder line corridor sites are known for their long history of habitation. However, both sites are disturbed which made subsurface testing unnecessary. Even in their disturbed state these sites are considered as having a moderate potential of archaeological sensitivity.

Switching Stations. None of the three switching station sites appears to have the potential for containing intact cultural remains. Therefore, each of them was initially classified as having low potential for archaeological resources and did not require subsurface exploration (see Table 3.7-4).

Paralleling Stations. The 19 paralleling station sites were studied, and nine were found initially to be archaeologically sensitive: Leetes Island, Madison, Old Lyme, Stonington, State Line, Kingston, Elmwood, Attleboro, and East Foxboro. Subsequent systematic subsurface testing found no intact cultural remains at these sites (see Table 3.7-5).

Bridges to be Modified. Of the seven bridge modification sites, only three initially appeared to have potential for archaeological sensitivity: Johnnycake Hill Road, Burdickville Road, and Kenyon School Road. Subsequent systematic subsurface testing found no intact cultural remains at these sites (see Table 3.7-6).

In those project areas that did not appear to be severely disturbed in the assessment-level surveys, and which appeared to have moderate to high archaeological sensitivity based on the background research and environmental attributes, further archaeological work in the form of a locational survey was undertaken. In this level of survey, known as a Phase I Archaeological Reconnaissance Survey in Connecticut and Rhode Island and an Intensive Survey in Massachusetts, systematic subsurface testing was conducted in the project areas to conclusively determine the presence or absence of intact archaeological sites. This level of testing was conducted at 14 of the project impact areas after the DEIS/R was released. No intact cultural remains were found in any of the project areas.

3.8 PUBLIC SAFETY

Rail operations within the NEC present the potential for collisions between trains and vehicles and/or pedestrians crossing the tracks. The danger of accidents involving motor vehicles is largely limited to at-grade rail-highway grade crossings. Collisions involving pedestrians could occur at established at-grade crossings, at illegal paths across or along the railroad ROW, and at railroad stations with at-grade crossings. The potential for accidents would increase with increased speed of trains or increased use of crossings by trains, highway vehicles, or pedestrians.

3.8.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.8.1(a) Federal Regulations

There are no Federal regulations that specifically address assessment of public safety impacts. However, the Federal Highway Administration guidelines for preparation of an accident prediction model at grade crossings.[13] The guidelines include procedures for developing and calibrating an accident prediction model for vehicle-rail accidents. In addition, *FHWA Technical Advisory T6640.8a* provides general guidance on the preparation and processing of environmental documents and identifies public safety hazards and accident rates as among the impacts to be evaluated. Section 2 of the Amtrak Authorization and Development Act directed FRA to develop a plan to eliminate the remaining rail-highway grade crossings of the NEC. This plan was released in July of 1994 as part of the NECIP.

3.8.1(b) State Regulations

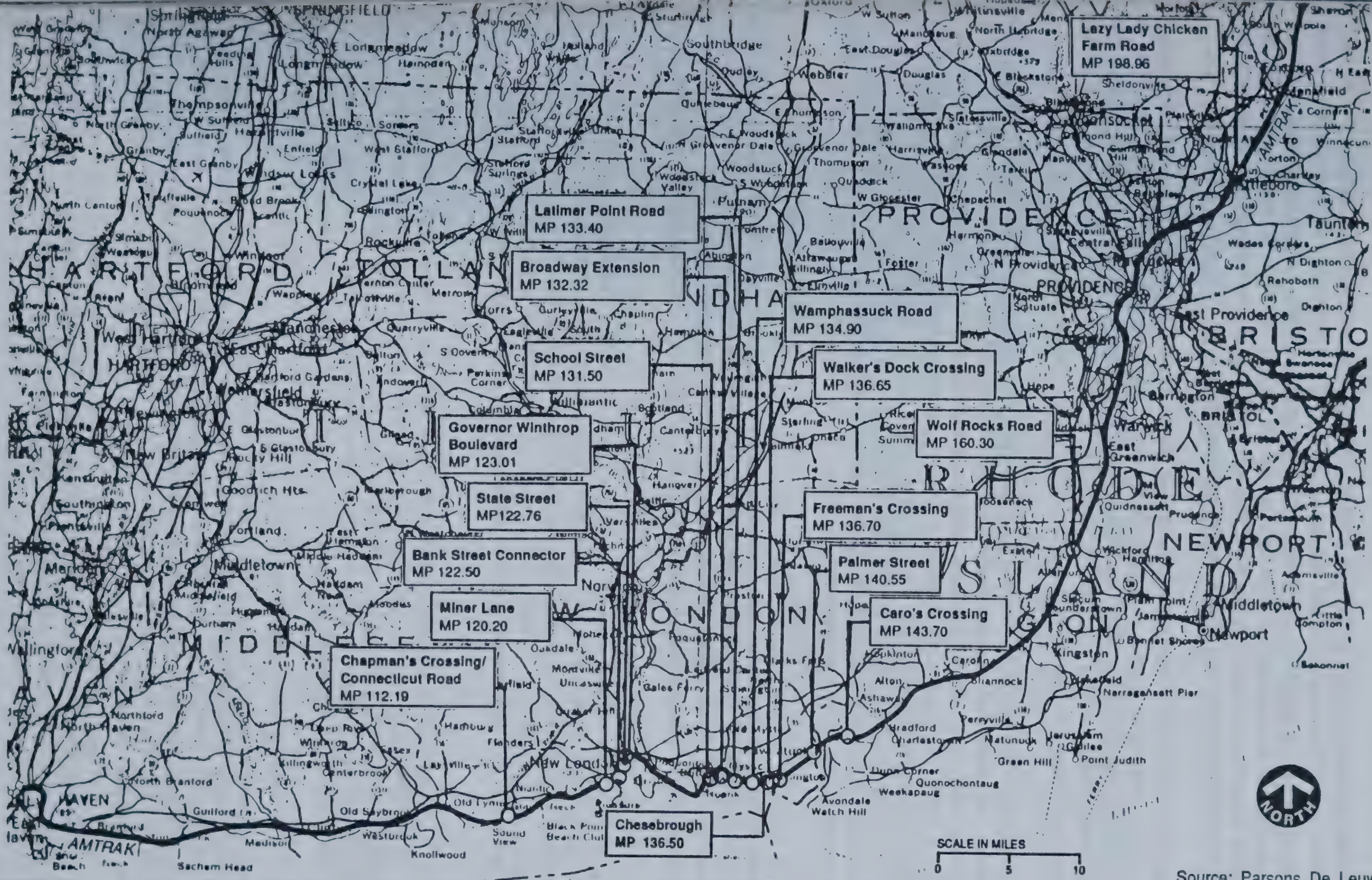
Connecticut, Rhode Island, Massachusetts. There are no state regulations that specifically address assessment of public safety impacts.

3.8.2 Affected Environment

This section identifies existing conditions with respect to train operations, traffic volumes passing through the at-grade crossings, the number of existing at-grade crossings, the types of traffic warning and control devices at those crossings, and accommodations for pedestrian movements both within established crossings and elsewhere along the corridor. Historical accident data was analyzed to form a baseline condition from which impacts from the Proposed Action can be evaluated.

3.8.2(a) Rail-Highway Safety

There are 16 rail-highway grade crossings of the NEC main line between Boston and New Haven (see Figure 3.8-1). Grade crossings are of two basic types: public and private. Public crossings are those which are under the control and jurisdiction of a public agency; private crossings are those where access across tracks is restricted to certain property owners. There are 10 public and six private grade crossings of the NEC in the study area. FRA maintains records on vehicular grade crossing accidents. Except for an accident at School Street in Stonington, CT, in 1994, no grade crossing accidents have been reported at these crossings since 1985. Table 3.8-1 lists all grade crossings within the study corridor as well as their locations, presence of traffic control devices, daily traffic, accident history, setting (urban, suburban, or rural), and the existing train speed.



AT-GRADE CROSSING LOCATIONS

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure
3.8-1

3.8.2(b) Pedestrian Safety

Records maintained by FRA for the past 5 years indicate an average of two people per year are struck by trains, both at station areas and along the NEC. Pedestrian crossings were identified through interviews with local police, Amtrak security patrols, and state and local officials; on-site surveys; letters from concerned citizens; and information offered at public meetings. (Tables 3.8-2 through 3.8-4 identify major illegal crossings within the NEC for Connecticut, Rhode Island, and Massachusetts, respectively.)

There are 22 stations between New Haven and Boston that are served by Amtrak and commuter rail. Pedestrians cross the tracks at 10 stations to access a platform while the remaining stations have either overpasses or underpasses. Amtrak's express service does not stop at any of the stations with pedestrian crossings, and Amtrak's conventional service stops at only three of these stations. (Table 3.8-5 lists the pedestrian crossings within the Amtrak and commuter rail stations.)

Forty-four pedestrian crossings of the rail corridor were identified: the 16 at-grade rail-highway crossings and 29 illegal locations. Although there are potentially numerous crossings in existence, only 29 were observed. These crossings were compiled by field observation, consultation with local officials, and comment by the public. As with vehicular crossings, increases in the number of trains traveling the corridor, the average operating speed of the trains, and the number of pedestrians increase the potential for rail-pedestrian accidents. However, as previously stated, improvements in traffic control and warning devices at crossings, and the elimination of crossings would reduce risks. Improved warning devices and barriers to pedestrians crossing at illegal locations would also reduce the likelihood of rail-pedestrian accidents.

3.8.2(c) Fire Safety

A system roughly similar to the electric traction system proposed for this project exists in the NEC between New York City and New Haven, CT. Records maintained by the Metro North Railroad Safety Department on their New Haven Line for the last 2 years indicate that approximately 38 fires were reported in 1992 and 15 in 1993. The most frequent incidents involved brush coming into contact with wires. All incidents are characterized by type below:

Type	**1992**	**1993**
Debris	2	1
Stubs or Chips	0	0
Brush	15	7
Ties	1	1
Electric	2	1
Equipment	6	3
Adjacent	6	0
Structures	6	2
TOTAL	38	15

Source: Metro North Railroad Safety Department, 1994

Beyond the typical hazards of combating blazes, firefighters are normally at no additional risk from electric shock when working on the electrified ROW. Before fire personnel or equipment are allowed on the ROW, the catenary system is de-energized allowing firefighters to proceed safely. However, the additional time required to make the ROW safe can affect the extent and intensity of a fire. Depending on the extent and location of the fire, one to four tracks may be de-energized.

Train passengers and crew are relatively safe from fire injury unless a fire occurs within a car or locomotive. This is because the fire department will not allow adjacent operations on other tracks if they would pose any risk of injury to passengers or crew of a passing train.

3.9 TRAFFIC, TRANSPORTATION, AND CIRCULATION

This section describes the existing transportation and traffic conditions which may be affected by the Proposed Action.

3.9.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.9.1(a) Federal Regulations

U.S. Coast Guard 33 CFR Section 114 and 115: These procedures regulate the alteration, rehabilitation, construction, and operation of bridges and causeways located over navigable waters of the United States.

Federal Aviation Administration 14 CFR Part 77: These regulations establish standards for determining obstructions to navigable airspace, and set forth the requirements for notifying the FAA of proposed construction or alteration projects which would affect the aforementioned.

3.9.1(b) State Regulations

In Connecticut, Rhode Island, and Massachusetts, there are no state regulations governing the evaluation of transportation and traffic impacts. However, the Massachusetts Executive Offices of Environmental Affairs and Transportation and Construction have guidelines for evaluating traffic impacts associated with projects in that state.

3.9.2 Affected Environment

This section describes existing intercity passenger service and ridership; use of the NEC by commuter and freight rail operators; traffic and parking conditions at the express railroad stations, and existing traffic at seven bridges to be modified; existing delays at highway-railroad grade crossings; and conditions at the five moveable bridges in Connecticut.

3.9.2(a) Existing Intercity Travel

Eighteen million intercity trips are made annually within the NEC between New York City, New Haven, Providence, and Boston. Travel in private automobiles accounts for slightly more than 13.4 million of these trips (74.5 percent). Air and train travel comprise the remaining intercity trips in this corridor. Airlines carry approximately 3.5 million trips annually (19.6 percent), while trains carry just over 1 million passengers (5.9 percent) each year.

Existing Passenger Rail Service and Ridership. Ten Amtrak intercity trains travel daily in each direction between New York and Boston via New Haven and the Shore Line, as indicated in Table 3.9-1. Two of these trains are express service, stopping at South Station, Back Bay, Route 128, Providence, and New Haven in the study area. The other eight trains serve the express stations, as well as Kingston and Westerly in Rhode Island, and Mystic, Old Saybrook, and New London in Connecticut. However, not every train serves all ten intermediate stations.

In addition to Amtrak intercity service, commuter rail service is provided at several of the intermediate stations in the NEC between New Haven and Boston. The MBTA provides commuter rail service between Providence and South Station in Boston. The Shore Line East provides service from New Haven to Old Saybrook. Table 3.9-2 indicates existing annual intercity and commuter rail passenger boardings and alightings at the five express stations between Boston and New Haven.

Each passenger both boards and alights; therefore, total boardings and alightings will be double the annual number of passengers. Table 3.9-2 looks at only the five express stations, not at total NEC ridership. As seen in Table 3.9-2, with the exception of Providence Station, commuter rail boardings and alightings vastly exceed those of Amtrak intercity service at these stations.

Other Existing Intercity Travel Modes. Aside from rail, there are three other intercity modes of travel available in the NEC: bus, aircraft, and automobile. Intercity bus travel is not addressed herein because it should not be affected by the Proposed Action. As the most time consuming mode of travel, intercity bus riders tend not to be time sensitive; reduced travel time is the primary attractive feature of the Proposed Action. Conversely, aircraft and automobile users are more likely to be affected by the electrification project because these travelers tend typically to be sensitive to travel time. Existing use of automobile and air modes is discussed below.

Existing Air Passenger Service and Ridership. As stated previously, approximately 19.6 percent (3.5 million) of all trips are made annually by air. Air passenger service in the NEC is provided between Boston and New York, Boston and Providence, Providence and New Haven, and Providence and New York. There is no direct commercial airline service available between Boston and New Haven (*January 1993 Official Airline Guide for North America*). Airline service between Providence and Boston is not addressed in this FEIS/R because (1) air service between these two cities is infrequent (5-10 flights per day, depending upon season) and (2) since air travel between these cities is overwhelmingly a through or connecting trip, i.e. flying from Providence to Boston's Logan Airport from where a connecting flight to the main destination is boarded. This type of air traveller would not be affected by high-speed rail service between Boston and Providence. Service between other city pairs is discussed below.

Boston-New York: There are 81 scheduled daily departures in each direction between Boston and the three New York airports (LaGuardia, John F. Kennedy, and Newark). Six commercial airlines provide daily service between Boston and New York starting at approximately 6:00 AM and lasting until approximately 10:30 PM. Generally, service is available every half-hour during this period.

Providence-New York: There are 48 scheduled daily departures in each direction between Providence and New York during the hours of 6:30 AM and 10:40 PM. Five airlines provide this service.

Providence-New Haven: There are three daily departures in each direction between Providence and New Haven. Only one airline provides this service.

Existing Automobile Travel. Automobile travel comprises the largest share of all modes of passenger transportation in this corridor. Of the approximately 18 million intercity trips in the NEC in 1988, 13.4 million trips were made by automobile. The approximate distance and off-peak driving time between the proposed express service cities in the NEC are shown below:

	Distance (miles)	**Travel Time**
Boston - Providence	48	1 hour
Boston - New Haven	148	2 hours and 40 minutes
Boston - New York	225	4 hours
Providence - New Haven	104	2 hours
Providence - New York	181	3 hours and 20 minutes
New Haven - New York	77	1 hour and 25 minutes

The existing total annual vehicle miles of travel (VMT) between major express service city pairs is as follows:

	VMT (millions)
Boston - New Haven	278
Boston - New York	1,760
Providence - New Haven	29
Providence - New York	593

3.9.2(b) Other Existing Rail Operations Using the NEC

Two commuter rail authorities and two freight companies operate on portions of the NEC between New Haven and Boston.

Existing Commuter Rail Operations. Commuter rail operations take place on two separate segments on the NEC. Amtrak operates commuter rail service between Boston and Providence under contract with the MBTA. At the present time, the daily one-way frequency of commuter trains ranges from five along the Providence to Attleboro segment to 65 trains along the Forest Hills to South Station segment (MP 223.65 to MP 229.30). Table 3.9-2 shows the existing commuter rail boardings and alightings at each Amtrak express station.

In 1990, ConnDOT contracted with Amtrak to operate a commuter passenger service between Old Saybrook and New Haven with five intermediate stops. This service is known as Shore Line East and consists of the operation of eight southbound and 10 northbound trains per day. Currently, no commuter passenger trains operate on the NEC segment between Old Saybrook and Providence. However, the Rhode Island Department of Transportation (RIDOT) is considering plans to reinstate commuter rail service south of Providence to Kingston. No specific program has been approved at this time.

History of Freight Rail, New Haven to Boston. For most of the current century, extensive railroad freight services were provided along the Northeast Corridor Shore Line Route between New Haven and Boston by the New York, New Haven, and Hartford Railroad Company (New Haven). The Shore Line was the scene of many daily local and through freight train operations as well as of intercity and local passenger train operations.

The adverse impacts of the Great Depression of the 1930s forced the New Haven into bankruptcy in 1935. For the period 1935 through the World War II years, the railroad was managed by Federal Court-appointed trustees. In 1947, the railroad was reorganized and returned to private sector control. A number of adverse conditions resulted in a second bankruptcy filing in 1961 and the installation of trustees to manage the railroad and to pursue a reorganization plan.

The operating trustees eventually sought inclusion in the then pending massive merger of the Pennsylvania and New York Central Railroad Systems, a position supported vigorously by the political, business, and labor leadership within the New England region. In 1969, the New Haven railroad properties were integrated into the merged corporate complex known as the Penn Central Railroad.

In the face of unfavorable competitive conditions within the Northeast, the Penn Central was forced into bankruptcy in 1970. Several other smaller railroads within the Northeast, including the Boston and Maine Railroad in northern New England, also fell into bankruptcy proceedings at that time period. Out of these bankrupt railroad systems, the Federal government acquired much of the railroad transportation properties of those railroads (excluding the Boston and Maine, which successfully sought independent reorganization) and created the Consolidated Rail Corporation (Conrail) to manage and operate the resulting railroad network. On April 1, 1976, Conrail became the operator of railroad services along the New Haven to Boston Shore Line.

In 1973, the Providence and Worcester Railroad (P&W) commenced operation of railroad freight services between the two cities which constitute its corporate name. Since that time, P&W has assumed freight service operations over many other route miles within the three-state southern New England region. P&W now operates over approximately 470 miles of trackage of which it owns approximately 170 miles. In 1982, under the provisions of the Northeast Rail Services Act of 1981, P&W undertook the exclusive provision of railroad freight services along the NEC route from the Massachusetts-Rhode Island state line to Old Saybrook in Connecticut, a line segment owned by Amtrak. In 1991, P&W acquired Conrail's freight operating rights from Old Saybrook to New Haven in Connecticut, and is the provider of all Shore Line freight train services in Rhode Island and Connecticut.

In Massachusetts, Conrail continues to provide local freight services along the Shore Line Route. P&W was granted limited overhead trackage rights along a segment of the Shore Line Route between the Rhode Island State

line to Attleboro in Massachusetts in order to connect to another part of the railroad system in Rhode Island, but, to date, the railroad has not exercised such rights.

Table 3.9-3 shows a typical daily pattern of freight service operations on various segments of the rail line between New Haven and Boston.

Freight Service Clearance. Currently, freight service on the NEC is constrained by the existing height restrictions in tunnels and at numerous overhead bridges. Although some individual bridge projects have improved clearances in recent times, the normal maximum vertical clearance envelope presently ranges between 16 feet-5 inches and 18 feet in height (from top of rail). These clearances are shown in the following list for each segment of the NEC:

- New Haven to Davisville — 17 feet-0 inches
- Davisville to Providence — 16 feet-8 inches
- Providence to Pawtucket — 17 feet-0 inches
- Pawtucket to Attleboro — 16 feet-8 inches
- Attleboro to Mansfield — 18 feet-0 inches
- Mansfield to Readville — 17 feet-4 inches
- Readville to Back Bay — no freight service
- Back Bay to South Bay — 16 feet-5 inches
- South Bay to South Station — no freight service

These vertical clearances preclude the movement of double-stack containers and enclosed tri-level automobile carriers through this corridor. Loads exceeding these clearance limits may be moved within specific, limited segments of the corridor, where there are no vertical or lateral obstructions (i.e., bridges and tunnels), with the approval of Amtrak's Clearance Engineer.

3.9.2(c) Existing Automobile Traffic Operations

This section discusses existing traffic conditions at the five railroad stations designated by Amtrak for express service and at the bridges proposed for modification.

Existing Traffic and Parking at Express Railroad Passenger Stations. Of the ten railroad stations currently served by Amtrak, five will also be served by the proposed more frequent express service. These stations are: New Haven, Providence, Route 128, Back Bay, and South Station. Amtrak also plans to provide service to New London, CT, by three or more of the high-speed express trains, with the level of service depending on future demand.

At each of these express stations, those signalized and unsignalized roadway intersections which are most directly impacted by traffic to and from the passenger stations were identified, existing traffic volumes and intersection configuration determined, and existing morning and evening peak hour operations characterized. The peak hours generally fall between 7:00 to 9:00 AM and 4:00 to 6:00 PM, although they may vary somewhat at particular locations.

Traffic operations were evaluated in the vicinity of the express passenger stations through an analysis of level-of-service (LOS) at critical intersections. LOS is a measure used to express quantitatively the quality or efficiency of traffic flow at a certain location or intersection. Included in the expression of operating conditions are travel time, speed, and freedom to maneuver, collectively termed as driver comfort. Factors in the determination of operating conditions included the physical attributes of the road, such as width, grade, horizontal curvature, and traffic control. Vehicle volume and mix (e.g., the proportion of cars and trucks) are also important factors. LOS is expressed in letters from A (the best, free-flowing conditions) to F (the worst, forced-flow conditions).

At South Station, the key intersection operates at LOS F in both the AM and PM peak periods. Both intersections analyzed at Route 128 Station show operation at LOS D. One of the two intersections analyzed at Providence Station operates at LOS F and the other at LOS B. No traffic volumes or studies were available for New Haven Station, although no traffic congestion was observed on local streets during evening peak hours. No LOS analyses were performed at Back Bay Station or New London Station because only minor increases in traffic are expected to result from the electrification project at these locations. Table 3.9-4 tabulates the existing levels of service noted above. The availability of existing parking at these stations is shown in Table 3.9-5.

Existing Traffic Patterns at Overhead Bridges. In many cases, the existing vertical clearance (the height from the top of the rails to the bottom of an overhead structure) is not sufficient to accommodate the planned catenary system.

Amtrak plans to lower the tracks by undercutting the railroad bed, wherever feasible, instead of raising bridge structures. At seven of the bridges, however, undercutting alone will not achieve the required clearance. Therefore, Amtrak proposes to raise or replace the following bridge structures:

- Millstone Road West, Waterford, CT
- Johnnycake Hill Road, Old Lyme, CT
- Burdickville Road, Charlestown, RI
- Kenyon School Road, Richmond, RI
- Park Avenue, Cranston, RI
- Pettaconsett Avenue, Warwick, RI
- Maskwonicut Street, Sharon, MA

Table 3.9-6 lists these bridges, the existing traffic carried by each bridge, and whether a detour will be necessary during the modification of these bridges.

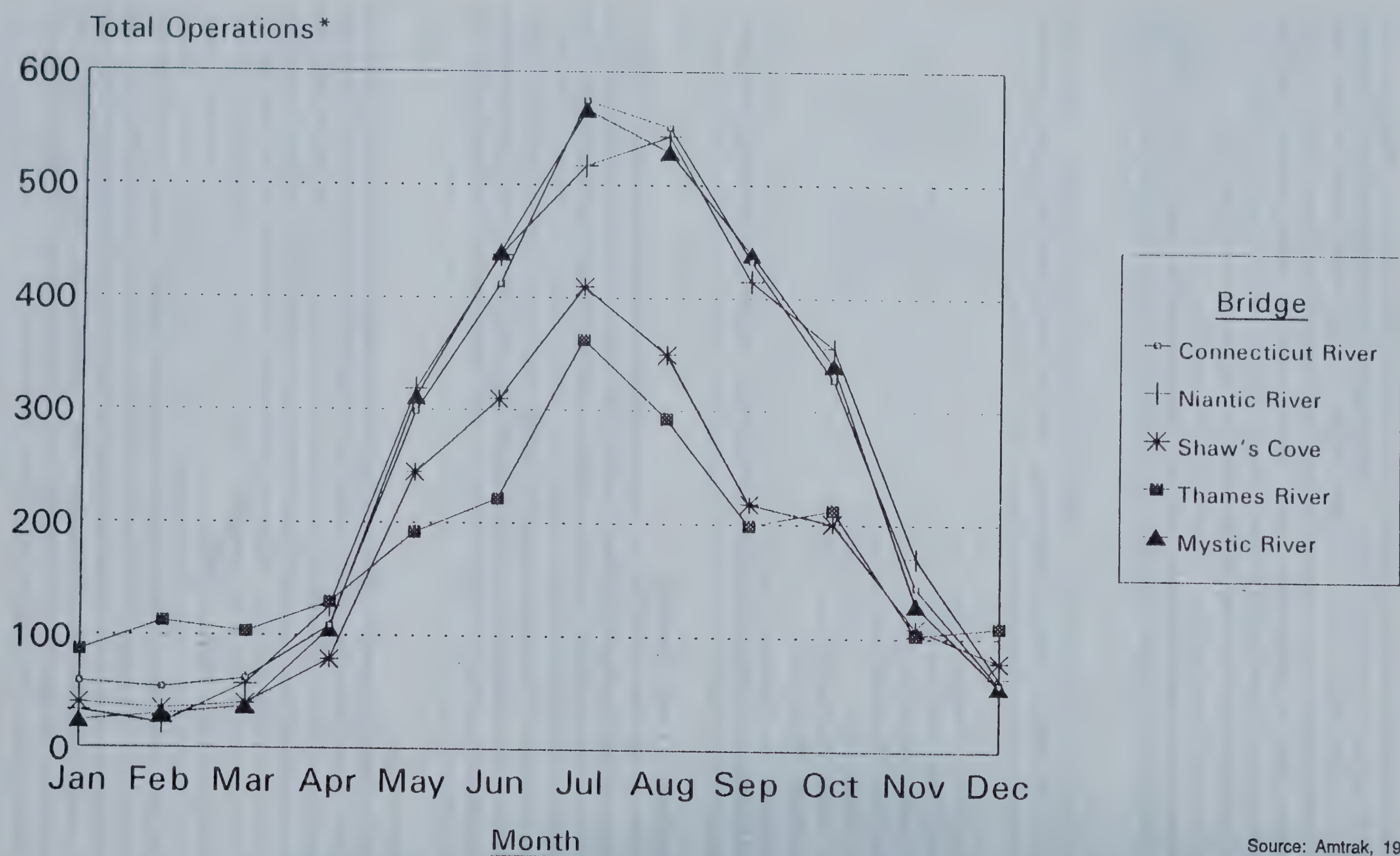
3.9.2(d) Existing Delay at Grade Crossings

Changes in Amtrak intercity operations may affect the frequency and duration of grade crossing gate closures, and therefore delays experienced by motorists at these locations. Over the years, state and local agencies have cooperated with Amtrak in closing most grade crossings or replacing them with overpasses or underpasses. There currently remain 16 highway-railroad grade crossings between New Haven and Boston; these include both public and private crossings. Of these, 12 have automatic gates. These 12 crossings are listed in Table 3.9-7, which also provides information on the existing train speeds and frequency, the delay per train event, the average delay per vehicle for each train event, and a description of the existing characteristics of the roadway and the surrounding type of development.

3.9.2(e) Moveable Bridges

Key Bridge Data and Railroad Movements. There are five moveable bridges in Connecticut: the Connecticut River Bridge (MP 106.89); the Niantic River Bridge (MP 116.74); the Shaw's Cove Bridge (MP 122.60); the Thames River (Groton) Bridge (MP 124.09); and the Mystic River Bridge (MP 132.20). The earliest bridge, the Niantic River bridge, dates from 1906 and is scheduled for replacement as part of NECIP, as is the Thames River Bridge. Both the Shaw's Cove and Mystic River bridges were substantially reconstructed in 1984 under NECIP. A summary of key physical data is contained in Table 3.9-8. Table 3.9-9 lists the existing railroad movements across the five bridges for a typical weekday in 1993.

Monthly data compiled from bridge logs maintained by the Amtrak bridge tenders disclose a very wide seasonal variation in the number of bridge openings. Such variation is shown in Table 3.9-10 and Figure 3.9-1. The existence of any present conflict between railroad and marine transportation modes is limited to the warm weather months. During the warm weather months, when marine traffic is more frequent, efforts are made to keep bridges open when trains are not approaching or crossing. During the winter months, for the most part, the reverse is true: the bridges remain closed, opening upon demand of a mariner.



Source: Amtrak, 1994

* one operation includes one raise/lower cycle

1993 CONNECTICUT MOVEABLE BRIDGE SUMMARY

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 3.9-1

Conflicts are present, however, and there are a number of concerns on the part of mariners which frequently arise in any discussion of moveable bridge issues. One, mariners frequently cite the unreliable train schedules which affect their ability to avoid nuisance delays at the bridges. Two, mariners also cite the seemingly arbitrary and capricious behavior of the bridge tenders, who are Amtrak employees. From the perspectives of the mariners, the bridge tenders tend to give priority to train passages and not to mariners, causing delays in excess of those allowed by the U.S. Coast Guard regulations. Amtrak is aware of these concerns and has begun to meet with groups of mariners, boating industry representatives, and state and local government officials to air and to resolve such disputes.

3.10 AIR QUALITY

The primary pollutants produced by transportation sources include carbon monoxide (CO); oxides of nitrogen (NO_x), expressed as nitrogen dioxide or NO_2; and hydrocarbons (also known as volatile organic compounds, VOCs). CO, a colorless and odorless gas, is a by-product of incomplete combustion. At elevated concentrations, it can cause headaches and nausea. At much higher concentrations, prolonged exposure can lead to coma and death. The primary sources of ambient CO are automobile exhaust, power plant emissions, and incineration.

NO_x are products of fuel combustion. Nitric oxide, a colorless gas, is formed during combustion of fuels at high temperatures and pressures. Although it is relatively harmless, it can readily convert to nitrogen dioxide (NO_2), which can reduce the oxygen-carrying capacity of blood. Exposure to high concentrations of NO_2 can lead to respiratory illnesses such as bronchitis and pneumonia. NO_2 is also a major constituent of ozone formation. In most areas, motor vehicle exhaust is the largest single source of NO_x.

VOCs are a precursor to ozone and are a general class of compounds containing hydrogen and carbon. VOCs are emitted from fuels through evaporation and combustion. Two main types of VOCs are aromatics and olefins. Some aromatics are carcinogenic, while olefins are harmful to plants. At levels typically found in the ambient air, VOCs are not known to be toxic. However, VOCs in the air will react with oxides of nitrogen (NO_x) in the presence of sunlight to form photochemical oxidants (ozone), which are toxic.

To a lesser extent than CO, NO_x, and VOCs, sulfur dioxide (SO_2) and particulate matter of 10 microns or smaller (PM10) are emitted from transportation sources. SO_2 can irritate mucous membranes and damage vegetation, and is corrosive to many surfaces. PM10 has health implications because of its potential to penetrate deep into the human respiratory system.

3.10.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

This section describes the applicable regulations that govern air quality in the project corridor at both the Federal and state levels. This section also describes the procedures that will be needed to demonstrate compliance with these regulations and related criteria.

3.10.1(a) Federal Regulations

National Ambient Air Quality Standards (40 CFR Part 50): Under the authority of the Clean Air Act and the 1990 Clean Air Act Amendments (CAAA), EPA has established a set of Ambient Air Quality Standards (AAQS) for various criteria pollutants. These standards are intended to protect the public health and welfare (see Table 3.10-1). When levels of pollutants do not exceed the annual average standards and do not exceed the short-term (1-, 3-, 8-, and 24-hour) standards more than once per year, an area is considered in attainment of the National AAQS. The standards that are particularly relevant to transportation sources include carbon monoxide, ozone (O_3), and oxides of nitrogen (NO_x), expressed as nitrogen or NO_2.

Federal Conformity Rule (40 CFR Part 51, Subpart W): Section 176(c) of the Clean Air Act (42 USC 7670(c)) requires that all Federal actions conform to an applicable state or Federal implementation plan (SIP) developed pursuant to Section 110 and Part D of the Clean Air Act. For these purposes, a "Federal action" is any activity engaged in by a department, agency, or instrumentality of the Federal government, or any activity that a

department, agency, or instrumentality of the Federal government supports in any way, provides financial assistance for, licenses, permits, or approves. EPA has promulgated two separate regulations establishing criteria and procedures for demonstrating and assuring conformity of Federal actions to an SIP. The Transportation Conformity Rule (40 CFR Part 51, Subpart T) applies to all transportation plans, programs, and projects developed, funded, or approved by the FHWA under Title 23 USC or by the FTA under the Federal Transit Act (49 USC 1601 et seq.). The General Conformity Rule (40 CFR Part 51, Subpart W) applies to all other Federal actions including transportation projects funded through Department of Transportation operating administrations other than FHWA and FTA. For example, the General Conformity Rule applies to plans, programs, and projects developed, funded, or approved by the Federal Aviation Administration, the Federal Maritime Administration, and FRA. Accordingly, since Amtrak's proposed electrification project is funded through FRA and does not include FHWA or FTA funding, it is evaluated under the General Conformity Rule.

The General Conformity Rule requires that a conformity determination be made where the total of "direct" and "indirect" emissions of criteria pollutants or their precursors in a nonattainment or maintenance area exceeds specified thresholds (40 CFR § 51.853). "Direct emissions" are those that are caused or initiated by a Federal action and occur at the same time and place as the Federal action. "Indirect emissions" may occur later in time or be further removed from the action itself, but they (1) must be "reasonably foreseeable" and (2) must be emissions that the Federal agency can practicably control through its continuing program responsibility (40 CFR § 51.852). Because each of the three states through which the Proposed Action passes (Massachusetts, Rhode Island, and Connecticut) has areas that are in nonattainment with a National Ambient Air Quality Standard (NAAQS), FRA considered whether a conformity determination had to be made for the project in accordance with the General Conformity Rule.

In broad terms, Section 176(c) of the Clean Air Act and the General Conformity Rule define a "conforming" project as one that:

- conforms to the SIP's overall objective of eliminating or reducing the severity and number of air quality violations in a state, and achieving expeditious attainment of the NAAQS;
- does not cause or contribute to new NAAQS violations in the area;
- does not increase the frequency or severity of existing NAAQS violations in the area; and
- does not delay the state's timely attainment of NAAQS or impede required progress toward attainment.

Under the General Conformity Rule, FRA is not required to make an individual conformity determination for projects that, because of their size and expected level of emissions, do not have the potential to cause new NAAQS violations or contribute to existing violations. The regulations establish "de minimis" emission thresholds (40 CFR §51.853(b)) below which a project is exempt from individual project conformity review.

Clean Air Act Amendments - Title I: Title I of the CAAA addresses nonattainment issues related to O_3 and CO. It classifies nonattainment areas and specifies compliance deadlines for these areas. Within the project corridor, New Haven, Providence, and Boston are classified as serious nonattainment areas for O_3, and each of these areas must demonstrate a total net reduction in VOC emissions of 15 percent by 1996 when compared to their corresponding baseline emissions in 1990. These same areas must also reduce VOC emissions by 3 percent per year following the 1996 deadline.

Boston and New Haven have been classified as moderate CO nonattainment areas, and must establish transportation controls (e.g., Transportation System Measures/Transportation Demand Measures or TSM/TDM) to address CO levels. Providence has not been classified as nonattainment for CO.

Clean Air Act Amendments - Title II: Title II of the CAAA addresses mobile sources and stipulates more stringent emission standards for cars, trucks, and buses. This title also regulates fuel quality (such as gasoline volatility and diesel sulfur content); requires reformulated gasoline in the worst O_3 nonattainment areas and oxygenated fuels in the worst CO areas; and requires clean-fueled vehicles for certain fleets and other pilot programs.

Pending EPA Rule on Emissions from Locomotives: EPA published "Determination of Significance of No-Road Mobile Sources and Emissions Standards for Compression Ignition No-Road Engines over 50 hP" in the Federal Register of June 17, 1994. This rule does not apply to locomotives, however. EPA is working on rules regarding locomotive emissions but it will be some time before these rules are promulgated and published.

3.10.1(b) State Regulations

Connecticut.

Connecticut Ambient Air Quality Standards: Connecticut's AAQS, as given in CT Regulation Section 22a-174-24, are identical to the Federal standards for CO, O_3, and nitrogen dioxide (NO_2) (see Table 3.10-1).

State Implementation Plan Provisions: The nonattainment provisions in Connecticut's State Implementation Plan (SIP) Section 6-B require that a transportation project: (1) must not result in an increase in VOC emissions when compared to the no-build alternative, both short and long term; (2) must not result in any violations of the air quality standards; and (3) must be in compliance with the Regional Transportation Plan, the Regional Transportation Improvement Program, and the State Master Transportation Plan. The Connecticut SIP for transportation projects, submitted in November 1993, is currently being reviewed by EPA, and includes significant emissions reduction requirements for the transportation sector and for new transportation projects.

Demonstrating Compliance: To demonstrate consistency with the state's SIP provisions for attainment and maintenance of the O_3 standard, the VOC emissions for the proposed project must be less than the corresponding no-build alternative for both the long- and short-term bases. To estimate the emissions, a project-affected study area must be defined and agreed upon by the appropriate state and Federal oversight agencies, which typically include the ConnDEP, ConnDOT, and EPA Region I. These agencies should also be consulted to reach concurrence in the analysis methods, data bases, and modeling assumptions. VOC emissions are then estimated for the project completion year (the long-term base). If the project appears to be inconsistent with the SIP provisions, then mitigation measures must be evaluated to achieve this consistency by reducing emissions.

Demonstrating consistency with the CO provisions follows a similar process, except that dispersion modeling is used to estimate both 1- and 8-hour CO concentrations. Connecticut may require that mitigation measures be considered if predicted CO concentrations exceed 90 percent of the CO ambient air quality standards.

Indirect Source Review: A project that is projected to result in significant traffic generation or in changes in traffic demands and patterns, either of which degrades traffic flow through key intersections in the project area, requires state review by the CT Department of Environmental Protection (ConnDEP). The review process involves a detailed modeling analysis of CO concentrations in areas of high traffic congestion. This process will insure compliance with the state CO standards by requiring mitigation measures in areas with anticipated excessive CO levels. This indirect source review process is restricted to traffic sources.

Rhode Island.

Rhode Island Ambient Air Quality Standards: As stated in Rhode Island's Regulation 9, the state's AAQS are the same as the Federal standards for CO, O_3, and NO_2 (see Table 3.10-1).

SIP Provisions: The O_3 nonattainment provisions of Rhode Island's SIP require that the proposed project will not result in an increase in VOC emissions over the No-Build Alternative for both the short and long term. For CO, the SIP requires that the project must not create a new violation of the CO standards or exacerbate an existing violation. The SIP also requires consistency with the state Transportation Improvement Program. The revised Rhode Island SIP is being reviewed by EPA and includes significant emissions reduction for the transportation sector.

Demonstrating Compliance: Consistency with the state's SIP for O_3 is demonstrated by ensuring that the VOC emissions associated with the proposed project are less than the corresponding emissions from the no-action alternative in both the short and long term. Consistency with the SIP for CO is demonstrated by estimating 1- and 8-hour CO concentrations and ensuring that no new violations are created or existing violations are made worse.

Massachusetts.
Massachusetts Ambient Air Quality Standards: The Massachusetts AAQS, as described in Section 310 CMR 6.00 for CO, O_3, and annual NO_2, are identical to the Federal standards (see Table 3.10-1). The state also has a 1-hour NO_2 policy level (320 $\mu g/m^3$) which has been used to evaluate impacts from transportation and power generation projects.

SIP Provisions: The SIP provisions for Massachusetts are very similar to those of Connecticut and Rhode Island. Specifically, for O_3, Massachusetts SIP requires that the VOC emissions from the proposed project must be less than the corresponding emissions from the No-Build Alternative for both the short and long term. For CO, the SIP requires that the project must not result in any new violations or exacerbate any existing violations. The state SIP is being reviewed by EPA and is expected to include an enhanced Inspection and Maintenance Program for motor vehicles, and increased emphasis in TMS/TDM for all transportation projects, upon approval.

Demonstrating Compliance: Similar to Connecticut and Rhode Island, consistency with the Massachusetts SIP for O_3 is accomplished by ensuring that the VOC emissions from the proposed project are less than the emissions from the no-action alternative. Consistency with the SIP for CO is demonstrated by ensuring that there are no new CO standards violations, and that existing violations are not made worse.

3.10.2 Affected Environment

3.10.2(a) Ambient Air Quality in the Northeast Corridor

Each of the three states along the project corridor maintains a network of monitoring stations which sample ambient air concentrations and provide data to assess the impact of control strategies. The pollutants of concern are those pollutants which are primarily emitted from transportation sources. These include CO, O_3, and NO_2. In this section, the most recent information available from the monitoring stations for a full year (1991) is presented and compared to the Federal and state air quality standards (see Tables 3.10-1 and 3.10-2).

Connecticut. This area of Connecticut is presently classified as a nonattainment area for CO due to violations in the recent past. It is also classified as nonattainment for PM10 and serious nonattainment for O_3. It is presently classified as in attainment for NO_2.

Rhode Island. Rhode Island is in attainment for CO, NO_2, and PM10 throughout the state. The state is presently classified as a serious O_3 nonattainment area due to violations of the ozone standard in the past.

Massachusetts. Portions of Massachusetts are in attainment for CO and PM10. Although there are currently no violations of the CO standard in this area of Massachusetts, the region is still classified as a nonattainment area for CO due to violations in the recent past. Massachusetts is also presently classified as in attainment for NO_2 and has a 1-hour NO_2 policy level of 0.17 parts per million (ppm). This level is not a standard that mandates compliance; rather, it is a health guideline or criterion that is used to assess the impact of both transportation and stationary source projects. This area of Massachusetts is presently classified as a serious O_3 nonattainment area.

3.10.2(b) Total Existing Emissions in the NEC

There are four general sources of emissions in the region. These include: mobile (transportation); point (identifiable, nonmobile sources such as power plants); area (nonpoint and other sources); and biogenic (or natural) sources. (Table 3.10-3 summarizes the emissions by source for VOCs, NO_x, and CO, respectively.)

3.10.2(c) Inventory of Existing Transportation Emissions in the Northeast Corridor

Emissions inventories are quantities of pollutants emitted over a given time period, which provide information about contributions from various sources. They are estimated by multiplying emissions factors by operations (e.g., a single locomotive trip from Boston to New Haven) by source activity (number of trips in one day). Emissions presented in this section were calculated for an average summer day (24 hours) and are based on EPA methodologies and EPA approved emission factors. The sources taken into account include those listed below.

Railroad Locomotives. Emissions from existing diesel-powered Amtrak locomotives, other diesel-powered passenger service locomotives, and diesel-powered freight locomotives were used to characterize the existing emissions, as well as to characterize the 2010 no-build condition in Section 4.10.4(c). Locomotive emissions were determined based on the procedures and data in EPA's Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources.

Motor Vehicle Sources. Emissions were calculated based on VMTs for automobiles and intercity buses in the NEC. Emissions from automobiles in each of the three states were determined separately, using the state-specific MOBILE5A inputs agreed upon in discussions with the three state agencies involved.

Aircraft Sources. Emissions were determined based on the procedures and data in EPA's Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources.

Existing VOC Transportation Emissions. Automobiles account for the overwhelming proportion of VOCs attributable to intercity transportation sources (81.9 percent corridorwide), with aircraft responsible for the second largest proportion (14.7 percent corridorwide), particularly in the Massachusetts portion of the NEC (see Table 3.10-4). Amtrak, other trains, and intercity buses are responsible for approximately 1 percent each corridorwide and in each state. In Connecticut and Rhode Island, automobiles are responsible for nearly all transportation VOCs in the counties surrounding NEC (93 percent in each state). In Massachusetts, the only state with a major international airport in the corridor, both aircraft (34 percent) and automobiles (59 percent) contribute significantly to VOC emissions.

Existing NO_x Transportation Emissions. Automobiles account for nearly half of all intercity transportation-related (7 percent from rail) NO_x emissions in the total corridor, and for 64 and 60 percent in Connecticut and Rhode Island, respectively (see Table 3.10-5). Amtrak trains are responsible for the second-largest proportion of NO_x in Connecticut and Rhode Island (19 and 29 percent, respectively), where commuter rail operations are minor. In Massachusetts, where a significant commuter rail system exists, trains other than Amtrak's account for the largest share of NO_x (40 percent), with automobiles accountable for the second-largest proportion (24 percent). As a whole, trains (both Amtrak and other) are responsible for 39 percent of corridorwide NO_x emissions from intercity transportation-related transportation sources.

Existing CO Transportation Emissions. In all three states and corridorwide, automobiles are responsible for the overwhelming majority of intercity transportation-related CO emissions (see Table 3.10-6). Only in Massachusetts are other sources responsible for more than 4 percent. Again, this is due to the presence of a major international airport in Boston, making aircraft responsible for 13 percent of CO emissions.

Existing SO_2 Transportation Emissions. Diesel locomotives and automobiles are the primary sources of SO_2 emissions in the corridor, representing 60.8 percent and 30.9 percent of the total SO_2 emissions, respectively. In Massachusetts, diesel-powered commuter trains contribute 55 percent of total SO_2 emissions in the state. Table 3.10-7 lists the SO_2 emissions by transportation source for the three states.

PM10 Emissions. Three of the four pollutants discussed above - VOC, NO_x, and CO - are generally recognized as the primary pollutants generated from transportation projects. SO_2 and PM10 are generally pollutants analyzed in the permitting of stationary sources such as power plants and not in the analysis of projects involving mobile and multiple transportation sources. Data on PM10 emissions from aircraft are sparse and generally unreliable;

therefore, PM10 was not assessed in a quantitative manner in this FEIS/R. A qualitative assessment of the projected impacts of this pollutant is contained in Section 4.10.2.

3.10.2(d) Existing Ambient Concentrations at Selected Sites

A microscale CO concentration assessment for two intersections in the vicinity of the Route 128 Station in Dedham, MA, was performed. This station was selected because it is anticipated to be the most congested express station in terms of project-generated automobile traffic. An assessment of the impact of locomotive pass-bys at three representative sections along the NEC was also performed.

Evaluation of Existing Ambient Concentrations Near the Route 128 Station. Two intersections near the Route 128 express station were modeled: University Avenue/Blue Hill Drive, and Blue Hill Drive/Route 128 South ramps. Figure 3.10-1 shows the location of these two intersections. Estimated 1- and 8-hour CO concentrations for 1992 are shown in Table 3.10-8 for the intersection of University Avenue/Blue Hill Drive, and in Table 3.10-9 for the intersection of Blue Hill Drive/Route 128 South ramps. With the exception of some sidewalk receptors on Blue Hill Drive/University Avenue, 8-hour CO concentrations in 1992 were estimated to be less than the 9-ppm standard. At some of the sidewalk receptors on Blue Hill Drive/Route 128 ramps, 8-hour CO concentrations were estimated to be slightly over the standard.

Maximum existing 1-hour CO concentrations were estimated from the 8-hour results by the use of an inverse persistence factor. No violations of the 1-hour standard of 35 ppm were encountered.

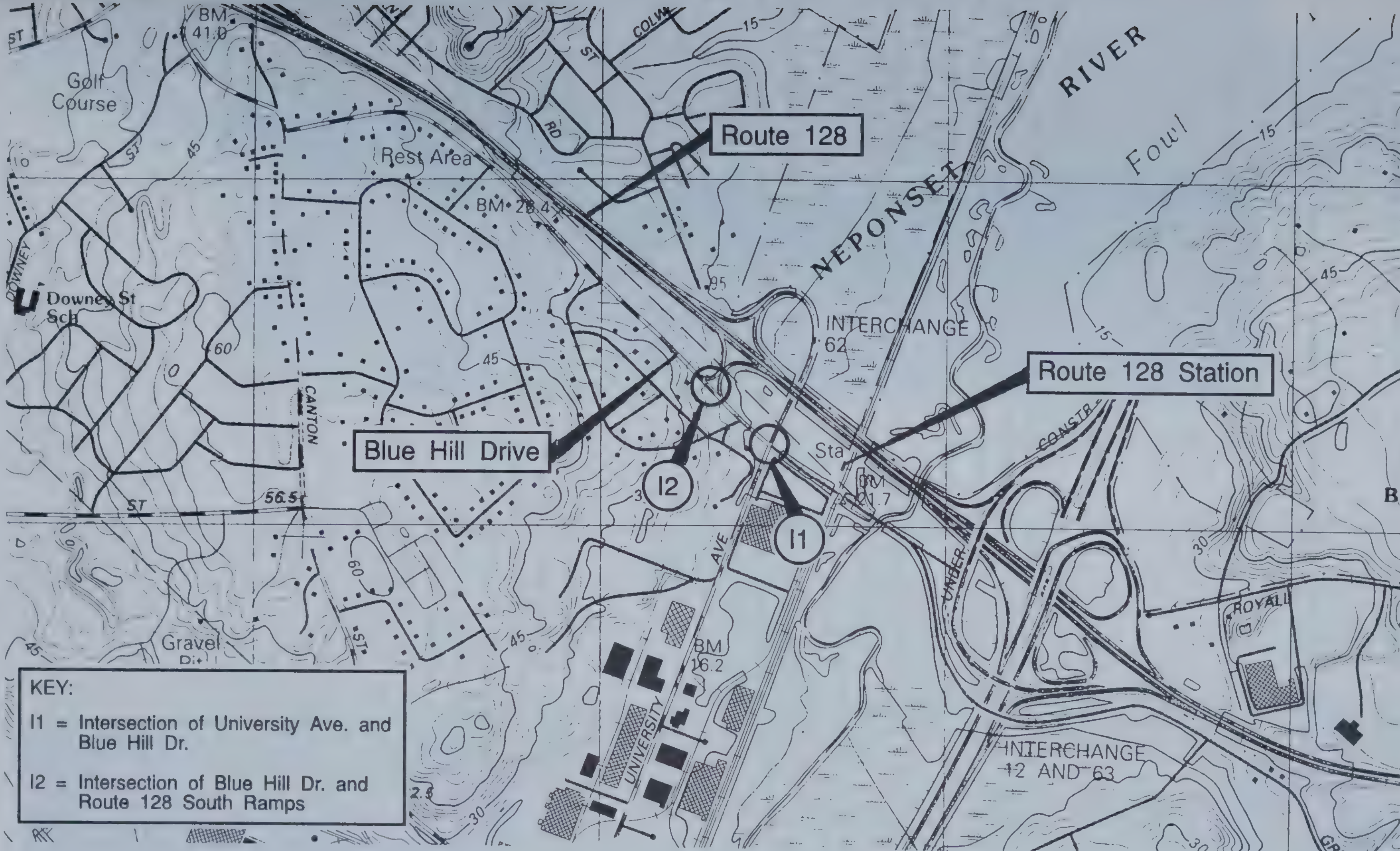
Existing Air Quality Impacts of Locomotive Pass-Bys. The purpose of this information is to demonstrate the effect of existing diesel locomotive pass-bys on air quality so that it can be compared to the impacts of the project alternatives. Three prototypical sections along the NEC were identified and selected for the modeling analysis. The selection was based on evaluating combinations of train operating characteristics (e.g., power settings and train speeds) and the density of nearby sensitive receptors. One section of the NEC was analyzed in each of the three states for peak, instantaneous CO and NO_2 concentrations associated with a single locomotive pass-by. The areas analyzed were located in Clinton, CT, North Kingstown, RI, and Sharon, MA. As shown below, the peak hour concentrations for locomotive pass-bys modeled in these three areas showed minimal increases from background levels and none exceeded existing pollutant standards listed in Table 3.10-1.

	CO	**NO_2**
Clinton, CT	0.001 ppm	0.1 μg/m
North Kingstown, RI	0.01 ppm	41.0 μg/m
Sharon, MA	0.001 ppm	8.0 μg/m

3.11 VISUAL AND AESTHETIC RESOURCES

There are two types of environments in the NEC study area that may be visually affected by the Proposed Action: existing views of the waterfront or other scenic areas, and developed areas in which facility sites are located. First, areas with existing views of the waterfront or other scenic areas are located and visually sensitive receptors (VSR) located within these areas are identified. VSRs are those residences, historic structures and districts, and parks, roadways, or other public locations with existing views or vistas of the waterfront or other scenic areas.

Second, developed areas in which facility sites would be located are identified and a determination is made whether each facility would be located in an area considered architecturally sensitive. Architecturally sensitive areas (ASA) are those areas in which the proposed facility may be significantly out of scale in height or mass, or out of character in style or substance, from existing structures of the neighborhood.



LOCATIONS OF MODELED INTERSECTIONS IN THE VICINITY OF ROUTE 128 STATION

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 3.10-1

3.11.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

3.11.1(a) Federal Regulations

There are no Federal regulations that specifically regulate visual and aesthetic resources.

3.11.1(b) State Regulations

Connecticut, Rhode Island, Massachusetts. There are no State regulations that specifically regulate visual and aesthetic resources.

3.11.2 Affected Environment

3.11.2(a) Visually Sensitive Receptors

Two major steps, desktop analysis and field verification, were used to identify VSRs. Desktop analysis included evaluation of U.S. Geological Survey topographic sheets and aerial photographs taken in April 1992 (scale: 1 inch = 200 feet). Two criteria were used to conservatively identify potential VSRs. It was determined that potential VSRs are those residences, restaurants, parks, and other public locations: (1) with a direct line of sight to the waterfront or other scenic view; and (2) located within approximately 1,500 feet of the ROW, which is the distance at which it is estimated that poles similar to those proposed for use to support the catenary are no longer significant in the view. As a result of the desktop analysis, approximately 200 potential VSRs were initially identified in the DEIS/R and marked on maps for field verification, and an additional 25 were identified in the FEIS/R primarily in response to comments.

Field verification of the potential VSRs was carried out in 1993 and early spring of 1994. Views were evaluated from the yards or decks of each residential potential VSR and from various locations along the roads or in the parks for nonresidential potential VSRs. Two criteria were utilized in identifying VSRs: (1) the existence of a view of the waterfront or other scenic area from the potential VSR; and (2) location of the ROW in the view. Any location that met both criteria was determined to be a VSR. Of the nearly 225 potential VSRs, 66 were determined to be VSRs (see Table 3.11-1). Photographs were used to record the existing views from each of the VSRs.

The field survey was used to identify another factor that is relevant in the evaluation of visual impacts, the visual complexity of the skyline in the view. The visual complexity (VC) of the skyline refers to the "busy-ness" of the fore- and background in a view. VC is rated high, moderate, or low. High VC is indicative of a busy view. A view thus rated may include dense vegetation, the presence of industrial equipment or utility poles, or dense, varied development. Low VC is indicative of a relatively uninterrupted view and is used here primarily to describe an uninterrupted and uncomplicated seascape. A view with low visual complexity would be more susceptible to adverse impact as a result of the addition of the project components to the view than a view with high visual complexity. (The VC of the view from each of the VSRs is shown in Table 3.11-1.)

In order to demonstrate the visual impacts of the proposed electrification project, views from several of the VSRs are shown in photographs in Figures 3.11-1 through 3.11-5. In Section 4.11, these photographs are altered to show the visual effects of the Proposed Action. These represent a variety of types of sensitive views in the corridor:

FIGURE 3.11-1. EXISTING VIEW FROM RESIDENCE AT 76 THIMBLE ISLAND ROAD IN STONY CREEK SECTION OF BRANFORD, CT

FIGURE 3.11-2. EXISTING VIEW FROM RESIDENCE AT 211 SENECA DRIVE IN NOANK SECTION OF GROTON, CT

FIGURE 3.11-3. EXISTING VIEW FROM RESIDENCE AT 162 WILCOX ROAD IN STONINGTON, CT

FIGURE 3.11-4. EXISTING VIEW FROM RESIDENCE AT 13 LAMBERT'S LANE IN STONINGTON, CT

FIGURE 3.11-5. EXISTING VIEW FROM HABORWATCH CONDOMINIUMS AT 4496 BOSTON POST ROAD IN WARWICK, RI

Location	Distance from Track (ft)	VC	Figure
L.I. Sound from 76 Thimble Island Road, Branford, CT	350	High	3.11-1
Palmer Cove from 211 Seneca Drive, Groton, CT	360	Moderate	3.11-2
L.I. Sound from 162 Wilcox Road, Stonington, CT	480	Low	3.11-3
Stonington Harbor from 13 Lambert's Lane, Stonington, CT	880	Moderate	3.11-4
Greenwich Bay from 4496 Boston Post Road (Harborwatch Condominiums), Warwick, RI	50	Low	3.11-5

Additional views shown in Figures 3.11-6 and 3.11-7 provide the basis for a relative comparison of the historic pole line and future catenary system shown in Section 4.11.

3.11.2(b) Architecturally Sensitive Areas

Both desktop analysis and field verification were used to identify ASAs in the NEC project area. Existing land use information was evaluated to determine which of the project facilities would be potential ASAs -- commercial or residential areas. This information was then field-verified by visiting the site locations. In addition, the field survey was used to estimate the potential of the facilities to be out of character with the surrounding development. The Roxbury Crossing substation is in an area of mixed commercial and residential character. The Noank paralleling station site is in an area that is primarily residential in character. The neighborhood surrounding each of these sites can be characterized as an ASA. None of the other facility sites can be characterized as an ASA.

3.12 NATURAL RESOURCES

Natural resources were identified at each of the sites where facilities are proposed to be developed or modified.

3.12.1 Regulatory Setting: Applicable Regulations, Policies, and Guidelines

This section describes Federal, state, and local regulations that govern the effects of the proposed project on natural resources, including wetlands, wildlife, floodplain, water quality, and special protected areas.

3.12.1(a) Federal Regulations

Section 404 (b)(1) of the Clean Water Act of 1977 (33 USC 1344): This Act provides that a "Section 404 Permit" is required for the discharge of dredged or fill materials into all waters of the U.S. This program is administered by the Army Corps of Engineers (Corps) with the assistance of the Environmental Protection Agency (EPA). Before a project may proceed with either dredging or filling of a wetland, it must be shown that efforts have been made to: 1) avoid the impacts, 2) minimize the impacts, and 3) if impacts are unavoidable, compensate for the impacts. Compensation for wetland losses must attempt to replace the wetland types and functions lost as a result of the project.

Section 401 of the Clean Water Act (33 USC 1341): This Act requires that any action that requires a Federal license or permit and that may result in a discharge of a pollutant into waters of the U.S. also requires water quality certification. This program is administered by the states and is designed to ensure that the discharge will comply with applicable Federal and state effluent limitations and water quality standards. Certification applies to both construction and operation.

Section 10 of Rivers and Harbors Act of 1899 (33 USC 403): This Act requires a permit from the Corps for any work which could obstruct or alter navigable waters of the U.S., including wetlands. The construction of any structure in, on or over navigable waters, the excavation from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters requires a Section 10 Permit from the Corps.

FIGURE 3.11-6. EXISTING VIEW LOOKING EASTBOUND AT FREEMAN'S CROSSING , STONINGTON, CT

FIGURE 3.11-7. EXISTING VIEW LOOKING SOUTH AT FREEMAN'S CROSSING, STONINGTON, CT

Executive Order 11990 - Protection of Wetlands: The Order requires that Federal agencies take action to minimize the destruction, loss, or degradation of wetlands. The public must also be given the opportunity to review any new construction plans or proposals.

The Coastal Zone Management Act of 1972 (16 USC 1451 et seq.): This Act is designed to encourage the protection of natural resources in coastal areas and to encourage states to establish coastal zone management plans, which are subject to approval by the Federal government. Federal actions should be consistent with state-approved plans, and the state plans must be consistent with applicable water and air quality laws; hence the state's programs are called the Federal Consistency Programs or Reviews. Connecticut, Rhode Island, and Massachusetts each have such an approved program, which is described in the appropriate sections below.

Fish and Wildlife Coordination Act (16 USC 661-667): This Act requires Federal departments and agencies, or any public or private agency requiring any Federal permit or license, to consult with the U.S. Fish and Wildlife Service (USFWS) and with the state agency responsible for administering wildlife resources, regarding proposed actions which could affect such resources. The goal of agency consultation is to eliminate, minimize, and/or mitigate adverse environmental impacts to fish and wildlife. The Act also authorized the USFWS and the responsible state agency to conduct studies for the purpose of determining possible damage to fish and wildlife resources as a consequence of proposed Federal actions. USFWS and state agency recommendations must be given "full consideration" by the Federal agency proposing or permitting the project.

The Endangered Species Act of 1973 (16 USC 1531 et seq.): The Act requires that Federal agency actions or actions which require a Federal permit do not jeopardize the continued existence of, or result in the destruction of any designated critical habitat for, threatened or endangered species (as listed in 50 CFR 17.11 and 17.12). In accordance with Section 7 of the Act, formal consultation with the USFWS or the National Marine Fisheries Service (NMFS) may be required if adverse impact may occur to any Federally listed species or critical habitat as a result of a proposed Federal action. This consultation may require an assessment of the potential impacts of the project on a listed species. Based upon this assessment, the USFWS or NMFS issues a biological opinion, which is binding, permitting the project to proceed with or without conditions, or prohibiting the project from proceeding.

Executive Order 11988 - Floodplain Protection: This Order directs Federal agencies to determine whether or not a proposed action will occur in the floodplain and, if it is in the floodplain, to determine the potential effects. Actions must be designed to avoid adverse effects and incompatible development in floodplains.

3.12.1(b) State Regulations

Connecticut. The State of Connecticut regulates freshwater wetlands and tidal wetlands through different divisions within the Connecticut Department of Environmental Protection (ConnDEP), however, the Proposed Action is being reviewed as a direct federal action. As a result, it is subject to Coastal Management Consistency Concurrence under Section 307(c)(1) of the Coastal Zone Management Act of 1972, as amended. The project also is subject to Water Quality Certification under Section 401 of the Federal Clean Water Act.

Coastal Management Act (C.G.S. sections 22a, 90 through 22a-112, inclusive): The Coastal Resources Management Division (CRMD) of ConnDEP administers the Federal CZM Act and regulates activities in the coastal boundary including tidal wetlands. These statutes, together with the policies and standards of the Connecticut coastal management statutes form the basis of the permit programs administered by CRMD and are known as the "The Coastal Management Act", which defines legislative goals for policies concerning development, facilities and uses within the coastal boundaries. These regulations also identify effects on marine fisheries, shell fisheries and wildlife as criteria for review in granting, limiting or denying permits. The intent of the regulation is to prohibit the existing bioproductivity of any wetland from being adversely and unreasonably affected.

Connecticut Water Quality Standards (C.G.L. 22qa-426): Regulations regarding implementation of the Federal water quality certification program are contained within these regulations. The proposed activities are reviewed

for their impacts on both inland and tidal waters before issuance of a Section 401 Water Quality Certificate. This program will be considered jointly by the Office of Long Island Sound Program and Inland Water Resources Division of ConnDEP.

Rhode Island. Rhode Island wetlands are regulated by two separate agencies. The Rhode Island Department of Environmental Management (RIDEM), Division of Freshwater Wetlands governs freshwater wetlands, while coastal wetlands and contiguous freshwater areas are regulated by the Coastal Resources Management Council (CRMC). Effects on floodplains and wildlife are also governed within these regulations, as described below.

Freshwater Wetlands Act (RIGL Sec. 2-1-18 through 2-1-24): Freshwater wetlands are defined as areas including bogs, marshes, swamps, ponds and land within 50 feet of the edge of wetlands, as well as river and stream floodplains and banks and areas subject to flooding or storm flowage and "other freshwater wetlands." Wetlands are determined by a predominance of wetland vegetation. Permitting is required for activities such as filling, draining, excavating, running a ditch or drain into, or otherwise altering the flow of water into or from a wetland. The Act also considers the effect on wildlife habitat and floodplains in reviewing permit applications. Alteration of a wetland can be denied if the values of "valuable" wildlife habitat are reduced. Valuable habitat is defined as those marshes, swamps, and bogs characterized by high diversity and wildlife production. In addition, it is a policy of the Act to prohibit net reduction in flood holding capacity of floodplains. In the period since the DEIS/R submittal, Rhode Island has revised their regulations governing the administration of the Freshwater Wetlands Act. These regulations now accept the wetland boundaries delineated according to the Corps of Engineers Wetland Delineation Manual, Technical Report Y-87-1, January 1987.

Coastal Resources Management Program (RIGL Section 46-23): The CRMC administers the Rhode Island Coastal Resource Management Program (CRMP), as well as the Federal Coastal Zone Management Act. CRMC reviews all activities which may impact the coastal zone or its resources. Among the regulated features are beaches and dunes, barrier beaches, coastal wetlands, coastal cliffs and banks, rocky shores and man-made structures. In addition, inland activities which may affect the coastal region are subject to CRMC approval. Coastal wetlands are determined by the presence of a predominance of plants adapted to living in soils saturated by salt water. Coastal wetlands and contiguous freshwater wetlands are regulated by the CRMC through a permit program. The CRMP also requires that permit applications address effects of a project on flood storage capacity and wildlife.

Endangered Species of Animals and Plants Act (RIGL Title 20, Chapter 37): This law provides protection for listed endangered species, a mechanism for state listing of species and enforcement authorization.

Water Quality Standards (RIGL Chapter 46-12, 42-17.1 and 42.53): These regulations, administered by the RIDEM Division of Water Resources require Water Quality Certification for Federally permitted activities which results in a point or nonpoint source discharge to a surface water resource.

Massachusetts. In Massachusetts, freshwater and coastal wetlands are governed by the Wetlands Protection Act, which is administered by the municipal conservation commissions, with overview by the Massachusetts Department of Environmental Protection (MDEP) Division of Wetlands and Water Resources (DWWR). Regulations implementing the act also address floodplains. The Massachusetts Coastal Zone Management Program (MCZMP) is administered by the state's Executive Office of Environmental Affairs (EOEA).

Wetlands Protection Act (M.G.L. c. 131 s.40). The regulations implementing this act (310 CMR 10.00) govern both inland and coastal areas. The regulation identifies "Areas Subject to Protection Under the Act," and locally issued permits are required for any activity that involves filling, dredging, removing, or altering these areas. The wetlands regulation also identifies wildlife habitat as an "area subject to protection under the act;" sections 10.37 and 10.59 of the regulation deal with rare species, while section 10.60 outlines wildlife habitat evaluation procedures including restoration of habitats. General performance standards outline work allowed within "land subject to flooding" (floodplain), as well as requiring compensatory storage for any lost flood storage volumes, and protection of wildlife habitat functions.

Coastal Zone Management Program (301 CMR 20.00): The CZMP regulations are established to comply with the requirements of the Federal Coastal Zone Management Act of 1972 and require Federal consistency concurrence.

Massachusetts Endangered Species Act (321 CMR 10.00): These regulations list threatened and endangered species and species of special concern, the methods for designation of adverse habitat and the responsibilities of state agencies. It requires that agencies shall review, evaluate and determine the impact on such species and use all practicable means and measures to avoid or minimize damage to such species or their habitats.

Certification for Dredging, Dredged Material Disposal and Filling in Waters (314 CMR 9.00): The Massachusetts regulations pursuant to the Section 401 of the Federal Clean Water Act, require water quality certification for any Federally permitted activity which results in a point or non point source discharge to a surface water resource. The MDEP Division of Water Pollution Control (DWPC) is responsible for administering the certification program.

Areas of Critical Environmental Concern (301 CMR 12.00): Areas of Critical Environmental Concern (ACEC) are regulated sensitive or unique habitats. The regulations indicate that agencies are to ensure areas that are considered critical to the survival of threatened or endangered species by the Massachusetts Endangered Species Act. Protected species are defined as species which are currently listed as endangered, threatened, or a species of special concern.

3.12.2 Affected Environment

This section identifies natural resources that occur at or within the immediate vicinity of the proposed project facilities, as well as special protected areas that occur elsewhere in the corridor. These resources include wetlands, critical wildlife habitats, endangered species, floodplains, coastal resources, and water resources. Summaries of the resources present at each of the proposed facilities sites can be found in Tables 3.12-1 through 3.12-5 for the substations, switching stations, paralleling stations, bridges to be raised, and moveable bridges, respectively. The methods for identifying these resources are described below.

3.12.2(a) Methods of Analysis

Wetlands. Wetlands within the study area were identified by the interpretation of available data including National Wetlands Inventory (NWI) maps prepared by the U.S. Fish and Wildlife Service (USFWS), Soil Conservation Service Soil Surveys, and state and local wetlands and soil maps; and through field verification of the presence of wetlands during site walks of the project sites.

Wildlife Habitat. Fish and wildlife resources in the NEC project study area include amphibians, reptiles, birds, and mammals. Previous studies, contact with government agencies, and existing and project-specific field review data were utilized to make determinations of whether species or habitat types occur in the study area.

Threatened and Endangered Species. Species, communities, and natural resource areas that are considered threatened or endangered are protected by the Endangered Species Act of 1973. Protected species are defined as species which are currently listed as endangered, threatened, or a species of special concern. The USFWS has been delegated the responsibility for administering the Endangered Species Act and maintains a list of species which are: endangered, i.e., in danger of extinction throughout all or a significant portion of its range; or threatened, any species which is likely to become an endangered species within the foreseeable future throughout all or a significant part of its range.

Floodplains. The study area crosses a variety of floodplains associated with rivers, streams, and surface waters. Since the Proposed Action may impact some portion of the floodplain, an evaluation of potential effects to the floodplains is required pursuant to the provision of Executive Order 11988 (Floodplain Management), 23 CFR 650A, and the National Flood Insurance Program. Executive Order 11988 requires Federal agencies to issue procedures to accomplish these goals, the Federal Railroad Administration cites E.O. 11988 as well as

Department of Transportation (DOT) Order 5650.2 as directives for determining floodplain impacts. DOT order 5650.2 is referred to as Floodplain Management and Protection, Policies and Procedures. It prescribes policies and procedures for insuring that proper consideration is given to the avoidance and mitigation of adverse floodplain impacts in agency actions. The Federal Emergency Management Agency (FEMA), which is charged with the administration of floodplain requirements, has mandated that local and state agencies be notified prior to the commencement of work in any area that would be inundated by a 100-year storm event. A 100-year storm is defined as a storm having a 1 percent chance of occurring in any given year. Data for the floodplain section of this report was taken from flood insurance studies conducted for FEMA and HUD.

Coastal Resources. Coastal resources include coastal waters, related marine and wildlife habitat, and adjacent shorelands, which together constitute an ecosystem of both terrestrial and estuarine environments. Examples of these resources include coastal bluffs, shorefronts, beaches and dunes, intertidal flats, tidal wetlands, adjacent freshwater wetlands, estuarine embayments, coastal hazard areas, developed shorefront, nearshore waters, islands, shorelands, and shellfish concentration areas. All coastal resources were identified, delineated, and classified according to accepted methods.

Ground and Surface Water Resources. The construction of railroad improvements and associated structures such as those associated with the Proposed Action has the potential to adversely impact groundwater quality during the construction phase by the alteration of the terrain and the staging of construction equipment and supplies, and subsequently by increased urban runoff from paved areas. Shallow sand and gravel aquifers are susceptible to contamination by water quality contaminants in runoff. While less susceptible than consolidated aquifers, bedrock aquifers are also subject to contamination by polluted recharge. The addition of impervious surfaces and the potential for localized diversion of runoff may have some impact upon groundwater recharge.

Surface water (ocean, lake, pond, river, and stream) is an important resource not only for human and wildlife consumption, but also for recreation. Each of the three states provides water quality standards for evaluating impacts from activities (particularly dredge and fill) that may affect such resources.

Special Protected Areas. The NEC passes through two land areas identified as ACECs by the Massachusetts DEP. These are the Fowl Meadow/Ponkapoag Bog and Canoe River ACECs. These areas are considered to be unique clusters with natural and human resource values worthy of a high level of concern and protection. Additional efforts are made to preserve and restore these areas and all Massachusetts EOEA agencies are directed to evaluate actions with this in mind. Apart from Massachusetts, there are other protected areas in the corridor, most notably the Great Swamp in Rhode Island.

3.12.2(b) Identification of Resources

This section identifies those significant natural resources present at each of the facility sites. Only those resources that occur at a site are discussed in the sections below. Tables 3.12-1 through 3.12-5 summarize the occurrence of natural resources at each project site.

Substations. There are no significant natural resources of concern present at the Warwick and Roxbury Crossing substation sites. The New London substation is sited in an area designated as a 100-year floodplain. There are three private wells on the north side of the Branford site, including one in proximity to the utility corridor.

Switching Stations. The Westbrook site is located across a road, but in the buffer of the wetland. The site falls within the watershed of the Wood and Pawcatuck Rivers, which has been designated a Sole Source Aquifer area by EPA. The Sole Source Aquifer provision of the Federal Safe Drinking Water Act gives EPA the authority to designate and protect aquifers that provide the principal or sole source of drinking water in an area as a Sole Source Aquifer. Prior to the commitment of Federal funds to a project, EPA must make a finding that the project will not adversely affect the aquifer. The Norton site is located within the Bungay River Water Resource Protection District and the buffer zone of adjacent wetlands.

Paralleling Station Sites. There are no significant natural resources at the Millstone, Elmwood, and Providence sites. Several of the sites are in coastal resource areas designated as shorelands; however, the sites are uplands and are not in a sensitive location.

Leetes Island: This site falls within the 100-year floodplain, with freshwater and tidal wetlands adjacent. It is designated a coastal flood hazard area.

Madison: This site lies within 50 feet of a freshwater wetland.

Readville: This site lies within the Fowl Meadow and Ponkapoag Bog ACEC.

Grove Beach: This site is within 50 feet of freshwater wetlands.

Old Lyme: This site occurs in an area expected to have moderate wildlife value because it is located at the edge of a forested community with a large scrub-shrub wetland across the tracks and an isolated wetland southeast of the site which may provide vernal pool habitat. The variety of habitats in the vicinity, and the vegetative diversity of the surroundings, provide moderate wildlife habitat values. The presence of recent deer browse on shrubs in the area is evidence of wildlife use.

Noank: This site lies within the buffer zone of a wetland which connects downstream with a tidal wetland restoration project. It is designated a coastal flood hazard area.

Stonington: This site has moderate wildlife habitat value, with habitat reportedly provided for a state-listed endangered species, in an adjacent area. The site is also located within the 100-year floodplain. Habitat characteristics include a predominantly open area with a large ledge outcropping and a dense growth of greenbriar dominating the western half of the site. Located in an oak forest with a variety of habitats available in the surrounding area, including wetlands, and with limited development around the site, this site would be expected to provide wildlife habitat in the form of nesting and cover for small mammals and birds. A state-listed endangered species, the American bittern (*Botaurus lentiginosus*) has been recorded within proximity of the project area.

State Line: This site lies within the Wood and Pawcatuck Rivers watershed, which is designated a Sole Source Aquifer Area by EPA.

Bradford: This site is located within the wetlands buffer zone, as well as the Wood and Pawcatuck Rivers watershed, designated a Sole Source Aquifer area by EPA. The site is also located within the areas designated by the Rhode Island Department of Environmental Management as a critical recharge area for local groundwater, and public wells lie 1,500 feet east and 3,000 feet south of the site.

Kingston: This site provides critical wildlife habitat, due primarily to its location within Great Swamp Wildlife Management Area, considered a Special Protected Area, and the variety of available habitat types including the presence of one very large (over 48-inch diameter) white oak nearby, which has numerous cavities. Many deer tracks and songbirds were noted, confirming the area's habitat value. This site is also located in the Wood and Pawcatuck Rivers watershed, which has been designated a Sole Source Aquifer area by EPA.

Exeter: This site is designated as moderate wildlife habitat and is in an area designated a Sole Source Aquifer area by EPA. The surrounding area provides a variety of habitats (turf fields, open water) which contribute to its wildlife value.

East Greenwich: This site is located within a designated wellhead protection area and local groundwater recharge area, as well as the Hunt-Annaquatucket-Pettaquamscott Sole Source Aquifer, as designated by EPA.

East Foxboro: This site, which is considered of moderate wildlife value, also lies within the Canoe River ACEC, although there are no critical resources nearby. It lies outside any protection areas for the ACEC's principal resource, the Canoe River Aquifer. The site is mostly forested with a mixed hardwood/softwood overstory and vegetative diversity. Wildlife habitation was indicated by the presence of numerous songbirds and tracks from rabbits, gray squirrels, and deer.

Canton: This site was relocated and is now situated at the edge of the powerline easement, occurring within 100 feet of a state regulated wetland.

Attleboro: This site is located on the northern side of the railroad in a vacant area between the railroad and a distant residential/industrial area. Runoff from the site flows toward the Ten Mile River, located over 100 feet east of the site. In accordance with MEPA requirements, wetlands on this site were flagged and reviewed with the Attleboro Conservation Commission, which concurred with the delineation of the wetlands (see letter of Attleboro Conservation Commission in Appendix I).

Overhead Highway Bridges. There are no significant natural resources in close proximity to the Johnnycake Hill Road, Pettaconsett Avenue and Park Avenue bridges.

Millstone Road (West) Bridge: There are two trackside emergent wetlands on the east side of the bridge, and a large forested wetland on the north side of the approach road.

Burdickville Road Bridge: At this bridge a designated forested wetland community is located within 10 feet of both the north and south side of the approach road. The bridge is also located over the Pawcatuck Sole Source Aquifer.

Kenyon School Road Bridge: This bridge is located approximately 200 feet from the Pawcatuck River and Pasquiset Brook. The bridge is also located over a sole source aquifer.

Maskwonicut Street Bridge: This bridge crosses over Beaver Brook and the rail line. There are wetlands in close proximity to the bridge that affect groundwater supplies, public water supplies, Beaver Brook and the local fisheries habitat. There is also a water supply well located approximately 3000 feet southwest of the bridge. In accordance with MEPA requirements, wetlands on this site were flagged and reviewed with the Sharon Conservation Commission, which concurred with the delineation of the wetlands (see letter of Sharon Conservation Commission in Appendix I).

Moveable Bridges. Five moveable bridges in Connecticut will require submarine cables to maintain continuous electrical service. All five bridges are located in estuarine areas and lie within coastal boundaries and coastal flood hazard areas.

All five bridges are located in Navigable Waters of the United States; as such permits are required for certain activities pursuant to Section 10 of the Rivers and Harbors Act along with Section 404 of the Clean Water Act. No activities are proposed to take place along the shore or in adjacent wetlands. The cable will be buried under the river bed 7 feet deep for a distance corresponding to the expanse between the bridge supports closest to the moveable sections. Any disturbance associated with these sites will be temporary. The burying of the cables would be considered dredge activities even though it is only a temporary disturbance.

The sensitivity of fisheries to the Proposed Action is evaluated as the potential for impacts on marine estuarine and anadromous fish. Of particular importance were winter flounder (Pseudopleuronectes Americanus) and the federally endangered Shortnose sturgeon (Acipenser Bevirostrum) in the Connecticut River. Potential impacts to fisheries include turbidity and disturbance to spawning fish or transient species, as well as impacts associated with electromagnetic fields associated with the cable.

Connecticut River: This site was identified by the U.S. Fish and Wildlife Service as occurring within the range of the Federally endangered species, shortnose sturgeon. Anadromous fish species are Species of Concern, as are shellfish. Winter flounder do occur in the area.

Niantic River: This site was identified by Connecticut DEP, Fisheries Division as supporting a very good winter flounder population and anadromous fish runs.

Shaw's Cove: This site is located in a developed area and does not provide an anadromous fish run, although larval forms of estuarine species would be expected to occur in the vicinity. The area around the bridge is described as Developed Shorefront on the Coastal Resource map.

Thames River: This site is also located in an area described on the Coastal Resource map as Developed Shorefront. Species of Concern include anadromous fish runs and winter flounder.

Mystic River: Located in an Estuarine Embayment according to the Coastal Resources map. This location provides an anadromous fish run and winter flounder habitat.

ENDNOTES

1. Conversation between Mr. James Duncan (DMJM/Harris) and Mr. Laurence Steffes (Amtrak), June 8, 1994.

2. Source: MA Department of Public Welfare. Based on a family of four.

3. One of the four trains, CT-1, uses only 1.6 miles of the NEC main line between the Belle Dock Branch and Airline Junction within the City of New Haven.

4. Freight carloads and related data provided by the Providence & Worcester Railroad Company under a Confidentiality Agreement.

5. *Employment and Earnings,* United States Department of Labor, Bureau of Labor Statistics, Washington, January, 1994.

6. One of these two trains, PR-2, does not use the NEC main line except to cross at the Lawn Interlocking.

7. Freight carloads and related data provided by the Providence & Worcester Railroad Company under a Confidentiality Agreement.

8. U.S. Department of Labor, op. cit.

9. *Connecticut's Boating Business*, a publication (undated) of the Connecticut Marine Trades Association, Essex, CT.

10. Ibid.

11. Letter from Elizabeth Higgins Congram, Assistant Director, Environmental Review, U.S. Environmental Protection Agency to Glenn Goulet, USDOT/RSPA, Volpe National Transportation Systems Center, November 30, 1993.

12. Popoff, John, Director, Electric Traction, Amtrak High-Speed Rail. Memorandum to Cassandra Koutalidis, DMJM/Harris, dated May 7, 1994.

13. *Federal Highway Administration (FHWA) Technical Report TS-86-215* (U.S. Department of Transportation/FHWA) and *Railroad-Highway Grade Crossings Resource Allocation Procedure-Users Guide,* FRA/DOT, 1987.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES AND CONSTRUCTION PERIOD IMPACTS

This chapter describes the benefits and impacts of the Proposed Action as compared to the No-Build Alternative. It considers the impacts of the project on the natural and manmade environment from both long-term (environmental) and short-term (construction period) standpoints. Some of the impacts described in this chapter (e.g., those associated with the overhead catenary and the electrical facilities) are directly attributable to Amtrak's proposal to electrify the NEC main line between New Haven and Boston. Others do not directly relate to electrification. Instead, they result from the increased frequency of intercity passenger trains operating between New York City and Boston. This increased frequency would be the result of increased ridership attributable to the improvement of intercity rail passenger service by NECIP as a whole, rather than by this specific project and would occur whether Amtrak uses electric trains or high-speed non-electric trains that might be developed. Moreover, many of these of these latter impacts (e.g., reduced marine traffic windows under moveable bridges in Connecticut) can be attributed only in part to the anticipated increase in the frequency of intercity rail passenger service. They are also attributable to the projected growth in the use of this segment of the NEC to provide expanded and enhanced commuter and freight rail service. While it is not possible in all cases to allocate a precise percentage of these impacts to the increased intercity rail passenger service as opposed to expanded commuter and freight service, the analysis suggests that, in a number of cases, increased commuter and freight traffic will account for a significant component of the projected impacts.

Finally, this chapter describes a number of impacts that might occur in the absence of the mitigation measures required in this FEIS/R, but that are not expected to occur as long as the required mitigation measures are implemented. In particular, Sections 4.2, 4.6, 4.9, and 4.10 of this chapter identify certain impacts on socioeconomics, energy, transportation, and air quality that might conceivably occur in the absence of the mitigation measures that this FEIS/R requires in order to protect the movement of commuter and freight rail traffic. Since the mitigation required in Chapter 5 is an integral part of FRA's preferred alternative, these hypothetical impacts are not expected to occur.

Proposed Action: The Proposed Action assumes completion of the electrification project as proposed by Amtrak, as well as all other planned NECIP improvements. With the addition of various measures to mitigate impacts as outlined in Chapter 5, this alternative is FRA's preferred alternative. It is assumed that the electrification and other improvements planned as part of NECIP will result in significantly improved rail service. This, in turn, would enable Amtrak to increase the frequency of service between Boston and New York City from the present level of 10 round trips per day (two express and eight conventional) to 26 round trips per day (16 express and 10 conventional).

As explained in Section 2.4.1, the No-Build Alternative consists of three scenarios of what might happen to intercity rail passenger service on the NEC mainline in the event that the Proposed Action was not undertaken.

No-Build Alternative - AMD-103 Scenario: The No-Build Alternative - AMD-103 Scenario assumes that no additional improvements are undertaken on the Northeast Corridor and that Amtrak service remains essentially the same as current service. It is expected that there would be a modest increase in demand that would be met by the addition of two trains daily in each direction. This scenario represents the increment of change between 1993/94 conditions (also known as the "existing baseline"), which are documented in Chapter 3 of this document, and the conditions that would be present in 2010 (the "future baseline").

No-Build Alternative - FF-125 Scenario: This scenario assumes that all NECIP improvements other than electrification are undertaken. It further assumes that the fossil-fueled locomotive being acquired as part of Amtrak's high-speed equipment purchase becomes the lead unit of a fleet of non-electric equipment that would

provide service between Boston and New York City. It is assumed that service under this scenario would be at the same frequency as that used in the analysis of the Proposed Action.

No-Build Alternative - FRA-150 Scenario: The third No-Build scenario assumes that all NECIP improvements other than electrification are undertaken. It further assumes that FRA's proposed high-speed non-electric locomotive program (to facilitate the development within the next 7 to 10 years of a non-electric locomotive capable of speeds of 150 mph and acceleration equivalent to that of the best electric locomotives) is successful. It is assumed that service under this scenario would also be at the same frequency as that used in the analysis of the Proposed Action.

4.1 LAND USE

Four types of land use benefits and impacts are discussed: (1) project-induced secondary growth and development; (2) displacement of residences or businesses; (3) consistency with Federal and state land use policies, plans, and programs, including coastal zone policies and the Federal Farmland Protection Policy Act; and (4) limitations on access to recreational facilities. Although there are no quantifiable measures for assessing land use impacts, the qualitative criteria shown in Table 4.1-1 were applied to evaluate potential project impacts and benefits of the Proposed Action.

TABLE 4.1-1 Land Use Evaluation Criteria

IMPACT CRITERIA	MEASURE
Consistency with local, state, or Federal land use policies, regulations, and programs.	Conflicts with local, state, or Federal land use policies.
Secondary growth or development impacts.	Project-induced changes in land use or growth patterns.
Severe limitations on access to recreational facilities.	Change in accessibility or attractiveness of recreational areas and facilities.
Displacement of existing residences or businesses.	Number and type of uses to be relocated.

Source: DMJM/Harris, 1993

The No-Build Alternative - AMD-103, FF-125, and FRA-150 scenarios would not require the construction of new facilities. Thus, there would be no direct impact to land use. The Proposed Action would require the construction of new facilities and would have a direct impact on land use. The following land use analysis addresses impacts from the Proposed Action, except where noted.

4.1.1 Benefits

Project-induced secondary development associated with the Proposed Action and No-Build Alternative - FF-125 and FRA-150 scenarios could occur in areas around the five express railroad stations. Although developable land and vacant commercial space around these stations are limited, as described in Section 3.1.2(e), some commercial growth is expected as a result of project-generated increases in ridership at these stations. The small amount of secondary development would have a relatively minor beneficial impact to land use.

4.1.2 Impacts

The overall impact to land use from the Proposed Action is considered to be relatively minor.

4.1.2(a) Environmental Impacts

The Proposed Action would result in displacement of one residence and one business along the 156-mile corridor. These displacements would result from the siting of two of the 25 electrification facility sites, the Norton Switching Station and the Warwick Substation. Under the Uniform Relocation Assistance and Real Property Acquisition Act and Regulations, Amtrak would be required to compensate financially the owners of property taken. No land use impacts are expected as a result of the siting of the remaining 23 facilities, the majority of which would be placed on undeveloped land.

As stated in Section 3.1.2(a), the facilities at Branford, Noank, and Stonington would be inconsistent with local zoning regulations. Although the existing zoning does not conform with Amtrak's proposed uses, the new land uses would be well suited to their respective sites and would not conflict with surrounding uses. No impact to land use is anticipated as a result of electrification at Southampton Yard in Boston, due to the industrial character of the site and adjacent area and its distance from sensitive receptors.

At the time the DEIS/R was published, Amtrak was proposing to locate the Noank Paralleling Station in Groton, CT, on a site that served as the parking lot for Esker Point Beach, a town recreational facility. The siting of the station would have required taking a portion of the lot (which is generally filled to capacity most summer days) limiting access to the beach. The paralleling station has been relocated to another nearby site and will not be constructed in the parking lot.

The proposed site of the Kingston Paralleling Station is within the Great Swamp Wildlife Management Area. However, the Kingston Paralleling Station cannot be relocated to any other available parcel. Therefore, a 4(f) Statement for this site has been prepared and is contained in Appendix G of this FEIS/R.

As stated in Section 3.1.2(c) and confirmed by the Soil Conservation Service, the Branford, Richmond, Bradford, Attleboro, and Canton facilities would be located on sites containing soils considered to be associated with prime or important farmland by the Soil Conservation Service. Under the Federal Farmland Protection Policy Act for land to be considered prime or important, it must not only contain designated soil types, but must also be used for producing food or fiber, or be available for those uses. Although the above sites have been preliminarily identified as containing prime or important farmland type soils, none of the sites identified is used for production or is available for agricultural use, and in many cases, the soils have been substantially disturbed or modified. Therefore, no prime or important farmland would be impacted by the Proposed Action.

4.1.2(b) Construction Period Impacts

Minor, temporary land use impacts are anticipated during construction of electrification facilities and installation of catenary poles of the Proposed Action. Impacts would be due to storage of supplies, machinery, fill, and other construction-related materials during construction. Wherever possible, the existing ROW and other storage areas could be utilized for these activities. No impacts would result from the No-Build Alternative.

4.2 SOCIOECONOMICS

This section provides a summary of the evaluation of five types of potential socioeconomic impacts and benefits: the alternatives' effects on local property values, local tax revenues, regional tourism patterns, employment, and minority and low income populations. Detailed discussions of socioeconomic impacts associated with potential effects on freight rail along the corridor and on the boating and marine-related businesses along coastal Connecticut are also presented. Although there are no regulatory standards against which to measure socioeconomic impacts, qualitative criteria were established to evaluate potential project impacts and benefits (see Table 4.2-1).

4.2.1 Benefits

The Proposed Action, together with the other improvements incorporated into the Northeast Corridor Transportation Plan (see Table 1.1-1), would result in significant time savings for intercity rail passengers and commuters. The Proposed Action would have a small beneficial effect on employment and income in the region, with the total long- and short-term employment created by the project generating an increase in regional employment of approximately 0.1 percent over existing levels. Amtrak anticipates that an additional 269 to 279 permanent positions would be created, including 24 train and engine crew positions in either New York or Boston (see Table 4.2-2). However, some train and engine crew staff jobs would be relocated from New Haven. Design and construction of the Proposed Action are estimated to generate between 600 and 700 temporary jobs over a 3-year period.

The Proposed Action, as an important part of the NECIP improvements, would be a major contributor to the improved trip times on the northern portion of the Northeast Corridor. This improved service is projected to result in increased ridership at the express stations, which could lead to additional development, both commercial and residential, in the areas surrounding the stations. Accessibility to transportation/transit modes is frequently cited in transportation journals as preserving/enhancing property values. Such growth and additional development are controlled by local municipal zoning and applicable Federal, state, and local permit applications. Effective application of these regulatory controls would prevent improper development and mitigate the impacts of future development.

TABLE 4.2-1 Socioeconomic Evaluation Criteria

IMPACT CRITERIA	MEASURE
Effect on property values	Demonstrated change in property values from similar projects
Effect on tax revenues/tax base	Demonstrated change in property values from similar projects
Effect on tourism patterns	Demonstrated change in tourism-based trips, revenues, or attractiveness from similar projects
Effect on employment and income generated by construction and operation	Change in employment or income
Disproportionate effect on minority and low-income neighborhoods	Greater impacts on minority and low-income neighborhoods than on nonminority neighborhoods
Effect on freight rail schedules and rail car volumes	Demonstrated change in employment and income levels
Effect on marine movements through the moveable bridges	Change in measured/theoretical boat passages through the moveable bridges
	Number and total duration of projected delays over 20 minutes

Source: DMJM/Harris, 1994

TABLE 4.2-2 Estimated Number of Permanent Amtrak Positions Resulting from the Proposed Action

CATEGORY	MUNICIPALITY	NO. OF POSITIONS CREATED
On-board Service Support	Boston	12
On-board Service Crews	Boston, New York City, Washington DC	59
Station Staffing	South Station Back Bay Route 128 Providence New London New Haven	9 7 5 10 4 7
Train and Engine Crews	Boston, New York	24[1]
Maintenance of Way Personnel	Boston or New Haven	12
Maintenance of Equipment Personnel	Boston or New Haven	120-130
TOTAL		269-279

Notes: [1]Fifty-one additional existing positions will be transferred from New Haven to either New York or Boston.

Source: Amtrak, 1993

Increased service frequency and decreased travel times would make the coastal communities more accessible to larger numbers of people, particularly those in the larger urban areas of Boston and New York City. While the focus of the project has been on the Boston to New York City express trains, substantial improvements in Amtrak service will result from improved trip times on conventional trains. As shown in Table 4.9-2, the conventional trip time from New York City to Mystic would be reduced by 30 percent from its present 3 hours, 12 minutes to 2 hours, 16 minutes after the NECIP improvements, including the Proposed Action, are completed. Similarly, the trip times between Boston's South Station and Mystic would be reduced by 27 percent from 1 hour, 42 minutes to 1 hour, 14 minutes. The tourism potential of coastal Connecticut, and to a lesser extent coastal Rhode Island, could be enhanced by this increased accessibility as larger numbers of intercity travelers are introduced to and become familiar with these areas.

Given that the projected ridership, service frequencies, and travel times associated with the No-Build Alternative - FF-125 and FRA-150 scenarios approach those of the Proposed Action, the above benefits, excluding possibly some of the detailed employment projections, would apply, to a large extent, to these No-Build Alternative scenarios as well.

4.2.2 Impacts

It was found that there could be some potential impact on property values, and subsequently on municipal tax revenues, as a result of the Proposed Action, but such impacts could not be quantified. To some extent, these potential losses in value could be offset by the increases in value resulting from increased accessibility. No adverse impacts to tourism or minority populations were identified. Increased train frequency, which would occur under the Proposed Action as well as the No-Build Alternative - FF-125 and FRA-150 scenarios, could have adverse impacts on freight service if the capacity improvements identified in the Northeast Corridor Transportation Plan were not built. This, in turn, could result in localized economic impacts. However, mitigation proposed in Chapter 5 includes those capacity improvements necessary to avoid any significant impact on freight service. Similarly, projected impacts at the moveable bridges from increased train operations may lead

to economic impacts (and benefits) to individual owners of marinas and marine-related businesses, although net impacts to the Connecticut coastal economy are considered minimal. Mitigation measures contained in Chapter 5 will address these potential impacts as well.

4.2.2(a) Environmental Impacts

Property Values and Tax Revenue. The potential future impact of a large regional project such as the Proposed Action on property values does not lend itself to quantification due to the large number of variables involved. The Proposed Action involves improvements to a long-existing and historically heavily traveled rail corridor. As discussed elsewhere in this chapter, the impacts associated with implementation of the Proposed Action would be limited primarily to the existing right-of-way and to properties adjacent to or in near proximity to this right-of-way. To the extent that close proximity to a major rail line would reduce property values, such reductions are already reflected, to a large degree, in the existing property values. While it is possible that the potential external effects of the Proposed Action, such as noise or diminished views, could have a localized effect on property values, mitigation of such externalities could reduce or eliminate the potential for property value and subsequent tax revenue effects. As described in Section 4.4, between 826 and 2,243 residences could experience increased noise levels from the Proposed Action, which could indirectly affect property values. In addition, 42 locations could experience effects on sensitive views as described in Section 4.11. It is expected, however, that most potential impacts would be substantially reduced or eliminated through the mitigation measures described in Chapter 5.

While sensitive views would not be impacted by the No-Build Alternative, there would be noise impacts associated with this alternative. For instance, approximately 1,500 residences would be impacted by the No-Build Alternative - FF-125 Scenario, and consequently property values could be adversely affected in a manner similar to the Proposed Action.

Section 4.5 documents that EMF levels from the Proposed Action are projected to be hundreds to thousands of times lower than guidelines recommended by several states and the international scientific community. However, recent media attention to this issue has created public concern which may, in turn, affect property values. A literature search (updated in July 1994) was conducted of several environmental, energy, and general databases, but no studies were found that addressed the effects on property values due to railroad electrification. Some literature was found on the property value effect of utility transmission lines. Although transmission lines are visually far more intrusive and have more powerful magnetic field strengths than the proposed catenary, some inferences can be drawn from the studies. The results of the search were generally split evenly between those studies that concluded that transmission lines do and do not affect property values. Further, some of the studies with each conclusion were found by independent reviewers to be flawed. Other studies noted that environmental factors are usually not major determinants in the price differential of properties. The major determinants of residential property values are house quality and size, lot size, and characteristics of the community, including tax rate and the quality of services such as schools.

The literature search was supplemented by calls to the Assessors' Offices in Boston, MA, and the Connecticut communities of Westbrook, Branford, and Groton. Assessors in these communities were consulted as DEIS/R comments on the EMF issue were received from residents in these communities. The issue of whether EMF is a factor in determining property values was discussed with representatives from these offices. In summary, all of the representatives responded that EMF is not used as an input to property valuations at present and none could cite an instance where a local property had been devalued due to EMF.

Thus, it can be concluded that if effects on sensitive views and noise levels cannot be mitigated, and if public perceptions regarding EMFs do not change, there could be a small effect on property values with the Proposed Action. However, Chapter 5 describes measures to be incorporated into the Proposed Action to mitigate these impacts and, thus, they would be reduced. Similarly, the effect of the project on tax revenues would be minimal. These conclusions remain valid for the No-Build Alternative as well, except that visual and EMF impacts are not relevant.

Tourism. A literature search of several environmental, economic, and general databases was conducted to identify studies which could aid in determining whether there would be any benefits to or impacts on tourism as a result of the Proposed Action, particularly in Connecticut, where the corridor lies in proximity to some of the state's most significant tourist attractions. Such effects could include benefits associated with improved access or impacts associated with potentially increased noise. However, no studies were found that addressed the effects of improved rail passenger service or its potential externalities (noise, air quality improvements, and alterations of views) on the surrounding environment.

Several commenters were concerned with the potential adverse impact of degraded views on tourism from the Proposed Action. As stated in Section 4.11.2, the catenary poles and wires would replace the signal poles present in existing conditions. The poles associated with the Proposed Action would not be significantly more intrusive than existing conditions.

The project involves the upgrade of an existing, major transportation facility that has been in place for over a century. While it is unlikely that there would be a significant change in tourist impressions of these attractions, tourism marketing by both Amtrak and the three states (and numerous counties and specific attractions like Mystic Seaport) has the ability to affect personal choices of vacation destinations. The Proposed Action and the No-Build Alternative - FF-125 and FRA-150 scenarios are projected to increase ridership significantly, and these new train riders (diverted from air travel primarily) represent a new potential pool of tourists.

Employment. In the Proposed Action, Amtrak expects to eliminate 51 train and engine crew (T&E) positions in New Haven, transferring some to either New York City or Boston. Approximately 23 jobs are expected to be created in New Haven after construction is completed; only six, however, would be T&E positions. The new T&E positions available in New York City or Boston would be offered to the New Haven workers. Most other jobs are expected to be phased out, through attrition, although these employees may find employment as part of the expansion of the Shore Line East commuter service. This change would have a minor effect on the employment base of New Haven; it could, however, involve a significant dislocation for the individuals involved.

Minority and Low Income Populations. The sites of two of the 25 electrification facilities (substations, switching and paralleling stations) as proposed by Amtrak would be constructed in either a predominantly minority or low income area: Providence paralleling station and Roxbury Crossing substation. (The potential of a different site for the substation proposed for Roxbury is discussed in Appendix K of this FEIS/R.) The remaining 23 facilities would be located in the undeveloped and sparsely populated, nonminority, or high-income neighborhoods that comprise the majority of the NEC. Therefore, minority populations would not be disproportionately affected by the project.

Since no new facilities are associated with the No-Build Alternative scenarios, minority and low income populations would not be impacted by these alternatives.

Shippers and Freight Rail. In the absence of mitigation measures, impacts to shippers along the NEC could be caused primarily by increased train frequency and not electrification per se, i.e., 26 non-electric trains a day in each direction would have the same impact on shippers as would 26 electric trains. Accordingly, the following discussion holds true for the No-Build Alternative - FF-125 and FRA-150 scenarios as well as for the Proposed Action.

Absent measures to minimize operational conflicts between passenger and freight rail service, 2010 passenger train frequencies in the No-Build Alternative - FF-125 and FRA-150 scenarios, and the Proposed Action could result in increased truck traffic and elevated freight rail prices in the Connecticut and Rhode Island portions of the NEC, with corresponding economic consequences. Review of Amtrak rail operation simulations indicates that absent measures to increase the capacity of the NEC, the 52 one-way trains scheduled for 2010 would reduce by up to 20 percent the time available for the Providence & Worcester Railroad (P&W) to provide freight rail service to its existing customer base at existing volume levels. The 43 rail users in this customer base generate 70,000 direct and indirect jobs and pay $1.8 billion in direct and indirect wages.[1] Additional operating impacts

are projected if freight rail volumes increase. Given the possibility of service delays at existing and projected freight volumes, price increases of at least 5 percent could be likely.

To evaluate the possible impact of such freight rail price increases, nine firms generating 64 percent of all current P&W NEC rail car movements were surveyed. Data indicate that a small number of firms dominate the rail freight marketplace in Connecticut and Rhode Island, using rail to transport raw materials which compete largely on the basis of price. Small variations in rail freight prices, therefore, are seen by these firms as especially relevant to their ability to compete.

All firms surveyed responded that rail price increases of as little as 5 percent would result in aggressive cost-cutting measures including, but not limited to, shifts from rail to truck and reevaluation of company hiring practices and investment decisions. Given small price differences between truck and rail for the short-haul rail movements constituting the bulk of NEC rail activity, 75 percent of the firms surveyed predicted that rail price increases above 10 percent could lead to increases in truck usage of more than 25 percent.

Given the large number of factors that impact company growth rates, hiring practices, and investment decisions, it is not possible to isolate freight rail prices from other factors to establish a direct causal relationship between freight rail prices and job gains or losses. Such a relationship could only be established after extensive analyses and with ready access to proprietary business records and financial data. It is possible, however, to determine what the impact on wages would be if rail price issues were determinative.

In Connecticut, companies served by P&W occupy 17 manufacturing, transportation, and mining standard industrial classifications. Connecticut Department of Economic Development figures indicate that the firms within these classifications served by P&W employ over 15,800 workers. Application of Bureau of Labor Statistics seasonably adjusted earnings data indicate $27,900 in annual average industry earnings, resulting in total direct earnings of $442,000,000 annually.[2] Each direct job generates $61,400 in indirect wages, or a total of $972,000,000 in indirect wages annually.[3] In Connecticut, therefore, a 1 percent increase in job loss or decrease in job creation directly attributable to increasing rail prices would result in the loss of 553 direct and indirect jobs paying $14,100,000 in annual wages.

In Rhode Island, companies served by P&W occupy 15 manufacturing, transportation, and agricultural standard industry classifications. According to Rhode Island Port Authority and Economic Development Corporation figures, firms within these classifications served by P&W employ over 5,100 workers. Port Authority data indicate that employees of these firms earn $28,800 annually, with total annual direct earnings of $148,900,000.[4] Each direct job also generates $50,550 in indirect wages, with a total of $260,700,000 in indirect wages generated annually.[5] A 1 percent increase in job loss or a 1 percent decrease in job creation attributable to increasing rail prices would result in the loss of 153 direct and indirect jobs paying $4,045,000 in annual wages.

Measures to mitigate impacts on freight service as a result of the Proposed Action are identified in Chapter 5. Simulations conducted for FRA indicate that with these capacity improvements, existing and projected intercity passenger and commuter schedules can be accommodated without any significant degradation to the freight service presently provided. The economic impact on freight rail shippers from the preferred alternative, therefore, should be minimal.

The State of Rhode Island proposes the development of a major port facility at the former U.S. Navy base in Quonset Point, RI. A major element of this proposed development is the provision of rail service using large dimension (double-stack container and tri-level automobile rack) rail cars. This service would use the NEC between Davisville and Central Falls, RI, where the P&W branches off the NEC. Presently, the clearances under 32 bridges over the NEC in this area are inadequate to accommodate these taller cars. The Rhode Island Department of Transportation (RIDOT) and FHWA have initiated a review of alternatives, including the preparation of an environmental impact statement (with FRA as a cooperating agency) to provide the necessary clearances and capacity for the additional traffic expected by the state. Amtrak has incorporated a number of

design changes into its plan in this area to accommodate potential future construction of a parallel track should that be the alternative selected by RIDOT and FHWA.

The Marine Industry in Coastal Connecticut. Analyses indicate that all five moveable bridges in Connecticut -- the Connecticut River, Niantic River, Shaw's Cove, Thames River, and Mystic River bridges -- would be closed more frequently and for longer periods in 2010 than at present (see Section 4.9 for further detail). The frequency and longer duration of bridge closures would be most pronounced in the morning and afternoon peak rail travel periods, reflecting projected daily intercity demand for travel as well as the introduction of Shore Line East commuter traffic across three moveable bridges -- the Connecticut River, Niantic River, and Shaw's Cove bridges. This would be true with the Proposed Action or No-Build Alternative - FF-125 and FRA-150 scenarios and, to a lesser extent, with the No-Build Alternative - AMD-103 Scenario. A number of harbormasters noted that there are similar peaking patterns in marine traffic as well, although less pronounced than in commuter rail patterns. The increased frequency of rail service would tend to limit opportunities for mariners to transit the bridges. Absent measures to reduce the impact of such increased closings, the increased train frequencies may make certain areas less attractive to mariners. Given the seasonal nature of recreational boating, the primary marine users of these bridges, the potential impact on marine industry is also seasonal, primarily in the months from the beginning of May to the end of September.

While impacts to mariners are primarily in the areas of convenience and free choice/movement, the steps mariners may take to reduce these impacts will likely have impacts, both beneficial and negative, on the marinas and marine-related businesses in the areas surrounding the moveable bridges. Two scenarios are likely:

Scenario #1: Relocation out of Area: Scenario #1 assumes that a boat owner will relocate out of the waterway area impacted by the moveable bridge, e.g., from the Connecticut River to inland waterways or to a marina in an adjacent coastal area not impacted by railroad bridges. The economic multiplier effects of the expenditures of this boat owner are thus removed from the area surrounding the moveable bridge, directly affecting the local economy. However, since most likely the existing choice of marinas is premised to some extent on proximity to residence or other attraction, it is unlikely the relocation would extend beyond the general area. Hence, the impact would likely not be at the level of the Southeastern Connecticut region.

Scenario #2: Relocation within an Area: This scenario, cited frequently by marina owners, assumes that the owners of larger boats will be drawn to marinas located downstream of the moveable bridges. Sensing this interest, marina owners downstream may be able to charge higher fees for mooring larger boats, possibly displacing the owners of smaller boats in the process. Marinas upstream may then be viewed as location alternatives by the owners of the smaller boats. The boats remain within the moveable bridge area, but are simply relocated within the area. Owners of marinas and marine-related businesses downstream of the bridges may see some increase in business revenue; owners of marinas and marine-related businesses upstream of the moveable bridges may see a decrease in business revenue.

In effect, this is what is happening today, according to the harbormasters and a number of marina owners at some locations. The larger boats do locate at marinas not impacted by the moveable bridges, paying in some instances a premium for such locations (which could be viewed as a moveable bridge penalty). Smaller boat owners and those owners not willing to pay premium prices are drawn to alternate locations, even those located upstream of the moveable bridges. The projected bridge closings in 2010 would tend to accelerate such relocations.

It is impossible at this level of analysis to determine which likely scenario would be followed by the majority of boat owners; thus it is impossible to quantify, in specific dollar terms, the impact that more frequent and lengthy future bridge closings would have on the marine industry and the local economies in the areas surrounding the moveable bridges. In Scenario #2, one marina upstream of a moveable bridge may lose moorings while a marina downstream may gain moorings. Thus, there may be a transfer of impact/benefit from one individual or business to another, but the net impact to the industry or local economy would be small.

The majority of commercial activity occurs upriver of the moveable bridges; therefore, the impact of decreased access on this traffic is considered minimal. Commercial and military movements which do occur through the bridges can be scheduled, to a large degree, to coincide with the available marine windows.

These impacts lend themselves to mitigation measures which are incorporated in the Proposed Action in Chapter 5.

4.2.2(b) Construction Period Impacts

In the areas of property values and tax revenue, tourism, and minority and low income populations, no construction impacts are projected or anticipated from the Proposed Action or the No-Build Alternative.

Employment. As noted above in Section 4.2.1, the Proposed Action is envisioned as creating 600-700 temporary construction jobs over a 3-year period, which would not occur with any of the No-Build Alternative scenarios.

Shippers and Freight Rail. Construction of the Proposed Action would have the potential to affect freight rail movements and access to specific shippers as construction ties up portions of the main line and delays freight rail operations. Chapter 5 includes in the preferred alternative measures intended to reduce the potential for impacts in this area. Since no construction would be necessary for the No-Build Alternative, there would be no impacts to shippers and freight rail operators from this alternative.

The Marine Industry in Coastal Connecticut. No socioeconomic impacts are anticipated from construction at the moveable bridges for several reasons:

- Due to fish migration periods, the laying of submarine cables at the moveable bridges would be restricted to the period October 1 - January 31, the off-peak season for recreational boating.
- The actual construction period in the marine environment would last approximately 10 to 20 days, a relatively short construction period.
- Marine traffic would continue to be accommodated at the bridges during the construction period.

4.3 HISTORIC RESOURCES

This section summarizes potential effects, as defined in Section 106 of the National Historic Preservation Act of 1966 (NHPA), on resources listed or eligible for listing on the National Register of Historic Places. Impacts to historic resources could result from five activities associated with the Proposed Action: installation of the catenary on railroad bridges; installation of protective barriers on roadway and pedestrian bridges; alteration or replacement of roadway bridges; installation of the catenary system or construction of electrification facilities on the ROW adjacent to or within sight of historic properties; and rail operations. There are no impacts to historic resources anticipated from the No-Build Alternative scenarios.

An inventory of historic properties along the corridor was conducted and is documented in Section 3.3 of this FEIS/R. The inventory identified historic resources listed or eligible for listing on the National Register in the project area (see Tables 3.3-1 through 3.3-3 in Appendix B). After consultation with the State Historic Preservation Office (SHPO) in each state, it was determined that all listed or eligible properties adjacent to or within sight of the ROW or electrification facilities would be considered within the zone of potential project impact. The potential for project effects to historic properties listed or eligible for listing on the National Register were evaluated in accordance with the NHPA Section 106 impact criteria of effect and adverse effect (see Table 4.3-1).

The findings of effect are summarized in Tables 4.3-2 through 4.3-4; they have been reviewed with each SHPO, which has concurred with these findings. A memorandum of agreement (MOA) for each affected state has been developed by FRA, in consultation with Amtrak, the state SHPO, and the Advisory Council on Historic Preservation. These agreements, which are further discussed in Chapter 5 and included in Appendix D of this

volume, stipulate the measures that would be carried out to mitigate adverse effects on historic resources resulting from the Proposed Action.

4.3.1 Impacts

Project effects on the sites noted below were evaluated by FRA on an individual basis in consultation with the SHPO in each state.

4.3.1(a) Environmental Impacts

Historic Railroad Bridges. Thirty-six railroad bridges that are listed or eligible for listing on the National Register were identified in the impact area. The Proposed Action would require the attachment of catenary wires over these bridges. While the installation of overhead catenary could affect the appearance of railroad bridges, in most cases the effect is not adverse. Because the span of most of these bridges is less than the distance between catenary poles (200 feet), installation of poles on the bridges should not be necessary. At five of the bridges, however, the bridge span exceeds 200 feet. Installation of the catenary supports on these bridges is necessary and would create an adverse effect as a result of the introduction of visual elements that are out of character with the bridges (see Table 4.3-2). The poles are, however, consistent with the railroad character of the bridges and would not destroy any of the physical elements of the bridges that make them eligible for inclusion on the National Register.

Historic Overhead Roadway and Pedestrian Bridges. Ten historic roadway or pedestrian bridges that pass over the tracks are listed or eligible for National Register listing. As a part of the electrification project, the catenary would be attached to the underside of these bridges and barriers erected along the entire length of the bridges to prevent the public from touching the wires. Alternative designs for these barriers, originally proposed as solid barriers 8 feet high, and running the full length of each side of the bridges to provide maximum protection, are being considered in light of comments made by the SHPOs. The catenary system alone is expected to have a minor impact on historic roadway bridges due to other modern elements already present in the visual landscape, such as transmission lines, street lights, and adjacent properties. However, the protective barriers could result in substantial visual and structural alteration to the historic characteristics of eight of the bridges, thereby creating a potential adverse effect (see Table 4.3-3). Of the remaining two bridges, Grand Avenue in New Haven already has solid barriers, while the Mt. Hope Footbridge in Boston would have a chain-link fence similar to the one currently in place.

Other Modifications to Roadway Bridges. The Proposed Action would require the raising of Maskwonicut Street Bridge, which could impact the adjacent stone arch. This action has been determined an adverse effect by the Massachusetts SHPO pending review of final plans for the bridge raising (see Table 4.3-3). Additional consultations with the SHPO would be carried out in accordance with the MOA.

Settings of Historic Properties. The field study identified 131 individual historic properties and 47 historic districts along the corridor listed or eligible for listing on the National Register. The Proposed Action would require the installation of overhead catenary and 13,000 catenary poles at approximately 200-foot intervals along the 156-mile corridor. The visual setting of certain historic properties could be affected by the catenary and supports, although for most properties this impact is expected to be moderate because: (1) other modern elements and railroad structures already intrude, such as tracks, signals, and utility lines; (2) poles would be spaced as far apart as possible; (3) a modern system of catenary would be employed that is far less visually intrusive than the existing system south of New Haven; and (4) in most instances the rail corridor passes by the rear elevation of the resource, thus diminishing the visual impact of the catenary. However, at 14 historic properties, catenary poles could introduce a discordant modern element to the historic landscape, thereby creating a potential adverse effect.

TABLE 4.3-1 Historic Resources Evaluation Criteria

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Alteration of the characteristics of a property that contribute to its significance.	Effect on characteristics of a property that contribute to its significance and National Register eligibility.	Effect on characteristics of property is adverse[1]

Notes: [1] As defined in Section 106 of the National Historic Preservation Act of 1966, an effect is adverse when the effect on a historic property may diminish the integrity of the property's location, design setting, materials, workmanship, feeling, or association. Adverse effects include but are not limited to (1) physical damage or destruction of all or part of the property; (2) isolation of the property or alteration of the character of the property's setting, when that character contributes to the property's qualification for the National Register; (3) introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting; (4) neglect of a property resulting in its deterioration or destruction; and 5) transfer, lease, or sale of the property without adequate restriction or conditions included to ensure preservation of the property's significant historic features.

Source: HRC, 1993

TABLE 4.3-2 Historic Railroad Bridges Potentially Adversely Affected

NAME OF RESOURCE	MUNICIPALITY	MILE POST	NATIONAL REGISTER STATUS[1]	PROJECT ACTION
Connecticut River Bridge	Old Saybrook, CT	106.89	Determined eligible	Catenary
Niantic River Bridge	East Lyme, CT	116.74	Determined eligible	Catenary
Thames River Bridge	New London, CT	124.09	Determined eligible	Catenary
Blackstone River Bridge	Pawtucket, RI	190.55	Recommended eligible	Catenary
Canton Viaduct	Canton, MA	213.74	Listed	Catenary

Notes: [1] Listed - previously listed on the National Register of Historic Places
Recommended eligible - recommended as a result of evaluations associated with the FEIS/R
Determined eligible - determined eligible in association with evaluations conducted prior to this FEIS/R by SHPO.

Source: HRC, 1994

In addition to potential adverse effects from the catenary system, one bridge modification and four electrification facilities could adversely affect the visual setting of historic properties. The replacement of the Kenyon School Road Bridge with a modern structure at a higher elevation could potentially affect the Kenyon Historic District. The Leetes Island Paralleling Station (MP 85.99) could have a visual impact on resources in the surrounding Route 146 Historic District. The view of the Exeter Paralleling Station (MP 161.78) would impact the W.R. Slocum House and surrounding rural landscape. The Elmwood Paralleling Station (MP 181.49) would impact the Gorham Manufacturing Company complex. Finally, the Roxbury Crossing Substation (MP 226.02) would have a visual impact on one of the Stony Brook Brewery buildings. The MOAs provide that final design in the vicinity of historic sites, including the location and color of catenary poles, will be reviewed by the SHPOs to ensure potential adverse effects are minimized.

The analysis of potential vibration impact from rail operations (see Section 4.4.4(a)) indicates that vibration from the Proposed Action would not be significantly different than that of the No-Build Alternative scenarios. However, concern was expressed over the possibility of adverse effects at one particular property in Connecticut. Although the vibration impact thresholds for historic properties were not exceeded in this area, the Memorandum of Agreement provides for further investigation and identification of appropriate mitigation measures.

4.3.1(b) Construction Period Impacts

There are no potential impacts to historic resources anticipated from construction of the Proposed Action. Since there is no construction associated with the No-Build Alternative scenarios, there would be no impacts.

TABLE 4.3-3 Overhead Roadway and Pedestrian Bridges Potentially Adversely Affected

NAME OF RESOURCE	MUNICIPALITY	MILE POST	NATIONAL REGISTER STATUS[1]	PROJECT ACTION
Olive Street Bridge (Bridge No. 3752)	New Haven, CT	73.08	Determined eligible	Barrier
Ferry Street Bridge (Bridge No. 3998)	New Haven, CT	74.38	Determined eligible	Barrier
Rocky Neck Park Trail Bridge	Old Lyme, CT	112.74	Listed	Barrier
West Street Bridge (RIDOT No. 401)	Westerly, RI	141.67	Determined eligible	Barrier
Main Street Bridge (RIDOT No. 372)	South Kingstown, RI	158.32	Recommended eligible	Barrier
Hunt's River Road Bridge (RIDOT No. 7)	North Kingstown, RI	169.79	Recommended eligible	Barrier
Greenwood (Railroad) Bridge (RIDOT No. 2)	Warwick, RI	175.70	Recommended eligible	Barrier
Central Street Pedestrian Viaduct	Central Falls, RI	190.00	Recommended eligible	Barrier
Maskwonicut Street Bridge	Sharon, MA	211.62	Recommended eligible	Bridge Modification

Notes: [1] Listed - previously listed on the National Register of Historic Places
Recommended eligible - recommended eligible as a result of evaluations associated with the FEIS/R
Determined eligible - previously determined eligible by SHPO in association with evaluations conducted prior to this FEIS/R

Source: HRC, 1994

TABLE 4.3-4 Historic Properties Potentially Adversely Affected

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS	PROJECT ACTION
Route 146 Historic District	Guilford, CT	85.41	Listed	Facility
Old Saybrook Station and Freight House	Old Saybrook, CT	105.04	Recommended eligible	Catenary
Old Saybrook Interlocking Tower	Old Saybrook, CT	105.08	Recommended eligible	Catenary
New London Railroad Station	New London, CT	122.75	Listed	Catenary
Haley Farm Historic Rural Landscape	Groton, CT	129.3	Recommended eligible	Catenary
Wilcox Road Historic District	Stonington, CT	133.77	Recommended eligible	Catenary
Westerly Railroad Station	Westerly, RI	141.6	Listed	Catenary
Shannock Historic District	Richmond, RI	152.90	Listed	Catenary
Kenyon Historic District	Richmond, RI	154.00	Recommended eligible	Catenary & Bridge Modification
Kingston Railroad Station	South Kingstown, RI	158.20	Listed	Catenary
W. R. Slocum House	North Kingstown, RI	162.00	Recommended eligible	Facility
East Greenwich Historic District	East Greenwich, RI	171.80	Listed	Catenary
Gorham Manufacturing Company	Providence, RI	181.70	Recommended eligible	Facility
Downtown Providence Historic District	Providence, RI	184.50	Recommended eligible	Catenary
Attleboro Railroad Station	Attleboro, MA	197.15	Listed	Catenary
Sharon Railroad Station	Sharon, MA	210.50	Recommended eligible	Catenary
Canton Junction Railroad Station	Canton, MA	214.10	Recommended eligible	Catenary

Notes: [1] Listed - previously listed on the National Register of Historic Places
Recommended eligible - recommended as a result of evaluations associated with the FEIS/R
Determined eligible - determined eligible in association with evaluations conducted prior to this FEIS/R by SHPO.

Source: HRC, 1994

4.4 NOISE AND VIBRATION

This section discusses the projected noise and vibration impacts developed in the extensive noise and vibration analyses performed for the FEIS/R. The FEIS/R evaluates the potential environmental impacts of the project due to the following: (1) noise from train operations; (2) noise from traffic near railroad stations; (3) noise from fixed facilities (e.g., electric substations); (4) noise from construction activity; (5) ground-borne vibration from train operations; and (6) ground-borne vibration from construction activity.

4.4.1 Evaluation Criteria

Noise and vibration impacts are assessed using criteria that are specific to six types of impacts shown in Table 4.4-1.

TABLE 4.4-1 Noise and Vibration Evaluation Criteria

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Train noise at noise-sensitive receivers.	Projected increase in $L_{eq}(24)$ or L_{dn} compared with existing conditions.	Proposed FTA Criteria (see Table 4.4-2)
Traffic noise from railroad stations at noise-sensitive receivers.	Projected increase in peak-hour L_{eq} compared with existing conditions.	Increase greater than 5 dBA (Current FTA Criteria)
Electrification facility noise at property line of noise-sensitive land use.	Projected A-weighted substation sound level compared with existing conditions.	Projected level exceeds minimum hourly L_{90} by more than 5 dBA, and is: >55 dBA (daytime[1] occupancy) >50 dBA (nighttime[2] occupancy) Where audible discrete tones (e.g. transformers) are present, adverse impacts are assessed at levels 5 decibels lower than indicated above.
Construction noise at noise-sensitive land use.	Projected L_{dn} from construction.	Projected L_{dn} > 75 dBA for 30 days or more
Train-induced ground vibration at vibration-sensitive land use.	Project rms ground vibration velocity level, existing level, and number of events.	Exceeds of Proposed FTA Criteria, by land use category (see Table 4.4-3) and $\geq$ 25% increase in level or $\geq$ 2 times number of events
Ground vibration from construction at vibration-sensitive land use.	Projected rms ground vibration velocity level.	Exceedance of Proposed FTA Criteria

Notes: [1] Daytime = 7 AM to 10 PM
[2] Nighttime = 10 PM to 7 AM

Source: HMMH, 1994

4.4.1(a) Train Noise Criteria

Potential train noise impacts were evaluated based on projected noise increases relative to existing conditions at noise-sensitive locations. Depending upon the land use, this increase was measured in terms of either the 24-hour

equivalent sound level $L_{eq}(24)$, or the day-night sound level L_{dn}. Both of these measures represent the total dose of noise energy at a given outdoor location over a 24-hour period in terms of the A-weighted sound level (dBA). $L_{eq}(24)$ is applied for noise-sensitive land uses where sensitivity does not depend on the time of occurrence, such as schools, places of worship, and recreational areas. L_{dn} includes an added 10-decibel weighting imposed on sound levels occurring during the nighttime and is applied for residences, hospitals, and other buildings where people sleep. Section 3.4.2(a) provides more information on these descriptors.

Evaluation criteria for train noise impacts are based on those currently proposed for adoption by the FTA. These criteria, presented in Table 4.4-2, are based on Federal noise standards and well-documented criteria and research into human response to noise.

TABLE 4.4-2 Proposed FTA Noise Impact Criteria

EXISTING NOISE LEVEL (dBA) [L_{dn} or $L_{eq}(24)$]	LIMIT FOR NOISE LEVEL INCREASE (dBA)		EXISTING NOISE LEVEL (dBA) [L_{dn} or $L_{eq}(24)$]	LIMIT FOR NOISE LEVEL INCREASE (dBA)	
	L_{dn}	$L_{eq}(24)$		L_{dn}	$L_{eq}(24)$
<45	15	20	57-58	6	11
45	14	19	59	6	10
46	13	18	60-61	5	10
47-48	12	17	62	5	9
49	11	16	63	4	9
50	10	15	64-66	4	8
51	10	14	67-69	3	7
52	9	14	70-73	3	6
53-54	8	13	74-77	2	5
55	7	12	78-79	2	4
56	7	11	> 79	1	3

Source: FTA, 1990

4.4.1(b) Highway Traffic Noise Criteria

Evaluation criteria for highway traffic noise impacts are based on existing FTA guidelines, which identify a noise level increase of greater than 5 dBA in peak hour L_{eq} as an impact threshold.

4.4.1(c) Electrification Facility Noise Criteria

Noise impacts from electrification facilities were assessed based on the projected A-weighted sound level and tonal characteristics at the property line of nearby noise-sensitive receptors, as well as on the type of receptor and existing background noise. The evaluation criteria are based on a review of state and local regulations applicable to such facilities and are shown in Table 4.4-1.

4.4.1(d) Construction Noise Criteria

Noise impacts from construction were evaluated based on the predicted L_{dn} for construction noise. Based on the standards established by HUD, an L_{dn} greater than 75 dBA for long-term residential use would likely require mitigation. However, to account for the limited duration of construction, impact is assessed only when the activity will occur for 30 days or more at a given location.

4.4.1(e) Vibration Criteria

Vibration impacts from train operations on the corridor were evaluated based on the projected rms ground vibration velocity level (V_{dB}), expressed in decibels relative to a reference velocity of 1 μin (micro-inch) per second. The criteria are given in terms of velocity because the sensitivity of humans, buildings, and equipment to vibration has typically been found to correspond to a constant level of vibration velocity amplitude within the low-frequency range of most concern for environmental vibration (roughly 5 to 100 Hz). Criteria for ground-borne vibration impacts are based on those currently being proposed for adoption by the FTA as well as on the projected increase in vibration level and number of events (see Table 4.4-3). Vibration impacts for construction were evaluated based on these same criteria, with the added criterion that activity of less than 30 days duration is not an adverse impact. Criteria for building damage due to vibration are as follows: 100 dB for non-historic buildings and 95 dB for historic buildings.

TABLE 4.4-3 Proposed FTA Vibration Impact Criteria

LAND USE CATEGORY	GROUND-BORNE VIBRATION LIMITS (rms Vibration Velocity Level in dB re 1 micro-inch/second)	
	Frequent Events[1]	Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations.	65 dB	65 dB
Category 2: Residences and buildings where people normally sleep.	72 dB	80 dB
Category 3: Institutional land uses with primarily daytime use.	75 dB	83 dB

Notes: [1] "Frequent Events" is defined as more than 70 vibration events per day. Most transit systems fall into this category.
[2] "Infrequent Events" is defined as less than 70 vibration events per day. This category includes most commuter and intercity rail systems.

Source: FTA, 1990

4.4.2 Methods of Analysis

4.4.2(a) Analysis of Train Noise

To project future train noise for the Proposed Action and the No-Build Alternative scenarios, a train noise projection model was developed. Source, or existing noise measurements were taken for both the diesel-electric locomotive currently operating on the NEC between New Haven and Boston, and the AEM-7, the electric locomotive currently operating on the NEC south of New Haven, which was determined to be a conservative representative of the type of locomotive that would run in the study area. Measurements were also taken of the RTL gas turbine-powered trainset on the Empire Corridor (Albany-New York City) near Albany, New York, to obtain data for the No-Build Alternative - FF-125 Scenario. To obtain data representative of newer equipment, measurements were taken for the Swedish X2000 tilt train and for the German InterCity Express (ICE) trainset during demonstration program operations on the electrified portion of the NEC south of New Haven. All field measurements are contained in Chapter 4 of Volume II of this FEIS/R.

The measurements were taken to document noise levels for a variety of equipment types, track configurations, distances, and speed conditions. These data were then input to the model. The model was tested for observed

trains and calibrated to address any differences in actual and projected noise levels. The model was also calibrated to be able to address a variety of conditions in the corridor that could affect the noise levels at distances farther from the tracks, including: (1) intervening terrain and buildings; (2) ground conditions; (3) atmospheric conditions; and (4) track location conditions (e.g., in deep cut, in sloped trench, at grade, or on embankment).

Future projected commuter rail service and freight operations were also included in the train noise projections, with the same schedules, equipment, speed profiles, and train consists as those used in the DEIS/R (see Section 4.4.1.4 of Volume III of the DEIS/R). These future non-Amtrak operations are assumed unchanged between the future alternatives, and hence do not affect the overall differences in total train noise among the alternatives.

In addition to the three No-Build Alternative scenarios, three noise scenarios within the Proposed Action were evaluated. These scenarios -- designated the best case, the worst case, and the initial build case (Day 1 of electrification, anticipated in 1998) -- are intended to represent the range of potential noise levels and impacts stemming from the electrification of the corridor. The DEIS/R projected the 2010 electric train noise impact using the AEM7 locomotive currently in operation south of New Haven. As these locomotives were introduced to the NEC in the early 1980s, the results of the DEIS/R noise analyses could be overly conservative -- projecting greater noise impacts than are likely to occur -- given the more modern and noise-efficient electric trainsets to be acquired by Amtrak for use in the NEC.

In addition, it was considered beneficial to project noise impacts on Day 1 (1998) of electrification, when train frequency would likely be similar to the current diesel service of 10 trains in each direction. Therefore, three noise scenarios within the Proposed Action were evaluated for the FEIS/R.

The scenarios are defined by the following:

- Best Case 2010 — ICE trainset; Service frequency of 26 trains each direction
- Worst Case 2010 — AEM7 locomotive and Amfleet coaches; Service frequency of 26 trains each direction
- Initial Build — ICE trainset; Service frequency of 10 trains each direction

4.4.2(b) Analysis of Highway Traffic Noise

The potential for noise impact due to project-generated highway traffic was evaluated for streets near the express stations, where ridership, and therefore traffic, are expected to experience the greatest change. The change in traffic noise was estimated based on the projected change in peak hour traffic volume.

4.4.2(c) Analysis of Noise from Electrification Facility Sites

The major sources of equipment noise at the project facilities are expected to include outdoor, oil-cooled transformers, and ventilation equipment. Noise levels were calculated as a function of distance for these sources based on their anticipated operating characteristics.

4.4.2(d) Analysis of Construction Noise

Construction noise impacts were evaluated based on: (1) the type of construction machinery likely to be used for catenary installation, construction of electrification facilities, and bridge modifications, and (2) the duration of the construction. Projected construction noise during catenary installation and bridge modifications (including raising, replacement, and undercutting) was based on projections made in the Programmatic Environmental Impact Statement. Projected construction noise at the electrification facilities was based on noise levels for the type of equipment used in nonresidential construction.

4.4.2(e) Analysis of Train Vibration

Train vibration was projected based on a model developed in much the same way as the noise projection model described in Section 4.4.2(a). A comprehensive vibration measurement program was carried out as part of the DEIS/R study to document vibration levels from existing train equipment at various locations on the NEC between New Haven and Boston. In addition, the ground vibration generated by prototypical equipment considered for the project in its future electrification and No-Build alternatives was also measured for purposes of comparison with the existing equipment. These included the electric AEM7, X2000, and ICE trainsets operating on the electrified portion of the NEC south of New Haven, and the RTL turboliner in service on New York's Empire Corridor. The source vibration measurement locations were selected to cover a large geographic area and represent a wide range of soil types, track configurations, and operating conditions. The basic model inputs describing the existing environment matched those used in the train noise projection model.

Analogous to the analysis of train noise, three vibration scenarios within the Proposed Action were evaluated. These scenarios -- also designated the best case, worst case, and the initial build case -- are intended to represent the range of potential vibration impacts stemming from the electrification of the corridor. The vibration scenarios are defined by the following:

- Best Case 2010 — X2000 trainset
Service frequency of 26 trains each direction
- Worst Case 2010 — AEM7 and Amfleet coaches
Service frequency of 26 trains each direction
- Initial Build — X2000 trainset
Service frequency of 10 trains each direction

4.4.2(f) Analysis of Construction Vibration

Ground-borne vibration from construction was estimated based on equipment source data in the literature and the ground vibration propagation characteristics measured along the NEC. Estimates were made for three classes of equipment: light-duty for catenary installation and bridge undercutting (e.g., post-hole diggers and small earth moving equipment), heavy duty for facility construction and bridge raising and replacement (e.g., heavy trucks and large earth moving equipment), and pile driving equipment (e.g., for overhead bridge replacement).

4.4.3 Benefits

A projected benefit is illustrated in Figures 4.4-1 and 4.4-2. Figure 4.4-1 shows a graph of maximum noise level (L_{max}) versus train speed for typical Amtrak passenger express service train consists. A typical passenger train is defined as consisting of one locomotive and eight cars, except for the gas turbine consist (used in the No-Build Alternative - FF-125 Scenario), which is defined as two locomotives and seven cars. The reason for this difference is that two locomotives are necessary to provide sufficient power to move seven cars at high speeds.

The curves in Figure 4.4-1 show that at lower speeds, diesel locomotive noise is dominant and electric- and gas turbine-powered trains are significantly quieter than diesel trains. The gas turbine locomotive (No-Build Alternative -FF-125 Scenario), however, is louder in this speed range than the electric, due primarily to the fact that gas turbine engines operate at a high rotational rate irrespective of speed. At speeds of 80 mph or more, where wheel/rail noise becomes dominant, the AEM7 electric train (Worst Case Build scenario) is projected to be as noisy as the diesel and gas turbine trains. The ICE electric train (Initial Build and Best Base Build scenarios), however, is projected to be approximately 5 to 7 dB quieter even at these higher speeds. This quiet operation is attributable to such factors as differences in wheel conditions and aerodynamic design.

Although L_{max} is useful for comparing the overall noise of train equipment and is easy to understand, the Sound Exposure Level[6] (SEL) is more relevant to the assessment of noise impact since the impact criteria are based on total sound energy exposure. Thus, it is instructive to examine Figure 4.4-2, which displays a graph of projected SEL as a function of speed.

The curves projected in Figure 4.4-2 show that the ICE electric trains would be expected to generate less sound energy over the anticipated speed range than any of the other diesel, gas turbine, or electric trains. The FF-125 gas turbine-powered locomotive is projected to generate more sound energy than either the AEM7 or ICE electric trains, but only up to speeds of about 60 mph, at which point it generates the same sound energy as the AEM7. The diesel locomotive produces the highest level of sound exposure of all train types. At speeds greater than about 80 mph, however, all of the train SELs, excluding that of the ICE locomotive, converge to approximately the same level.

The projected benefit is that electric trainsets are quieter than other fossil-fueled locomotives at speeds below 80 mph, which generally occur in more densely-populated, noise-sensitive urban areas. These areas are generally listed in Table 4.8-4, which indicates existing and projected 2010 maximum allowable speeds by milepost between New Haven and Boston.

Similar benefits from electrification are projected in the area of train vibration. The analyses reveal three findings:

- Diesel (F40PH, roughly comparable to the AMD-103), electric (AEM7), and gas turbine (RTL) locomotive-hauled Amtrak trains generate about the same overall level of vibration at similar speeds.

- Measurements of the ICE and X2000 trainsets tested on the NEC indicate that vibration levels generated by the ICE are 3 to 5 dB lower than those generated by the AEM-powered trains, but that the X2000 (Initial Build and Best Case Build scenarios) vibration levels are 6 to 10 dB lower than the AEM7 (Worst Case Build scenario) and 5 to 7 dB lower than the ICE. These observations were made based on comparison of measurements performed at a single measurement site in New Jersey; thus, site or track variations were eliminated and a valid comparison of the data could be made.

- Small differences of 3 to 5 dB may be attributable to the relatively new rolling stock of the European trainsets tested on the NEC compared with the standard revenue service fleet of AEM7s. However, major differences in equipment design may account for larger variations in vibration levels. Specifically, the X2000 is known to have a truck with a significantly lower unsprung weight per axle than either of the other electric trains, and this may account for lower dynamic loads and ground-borne vibration levels.

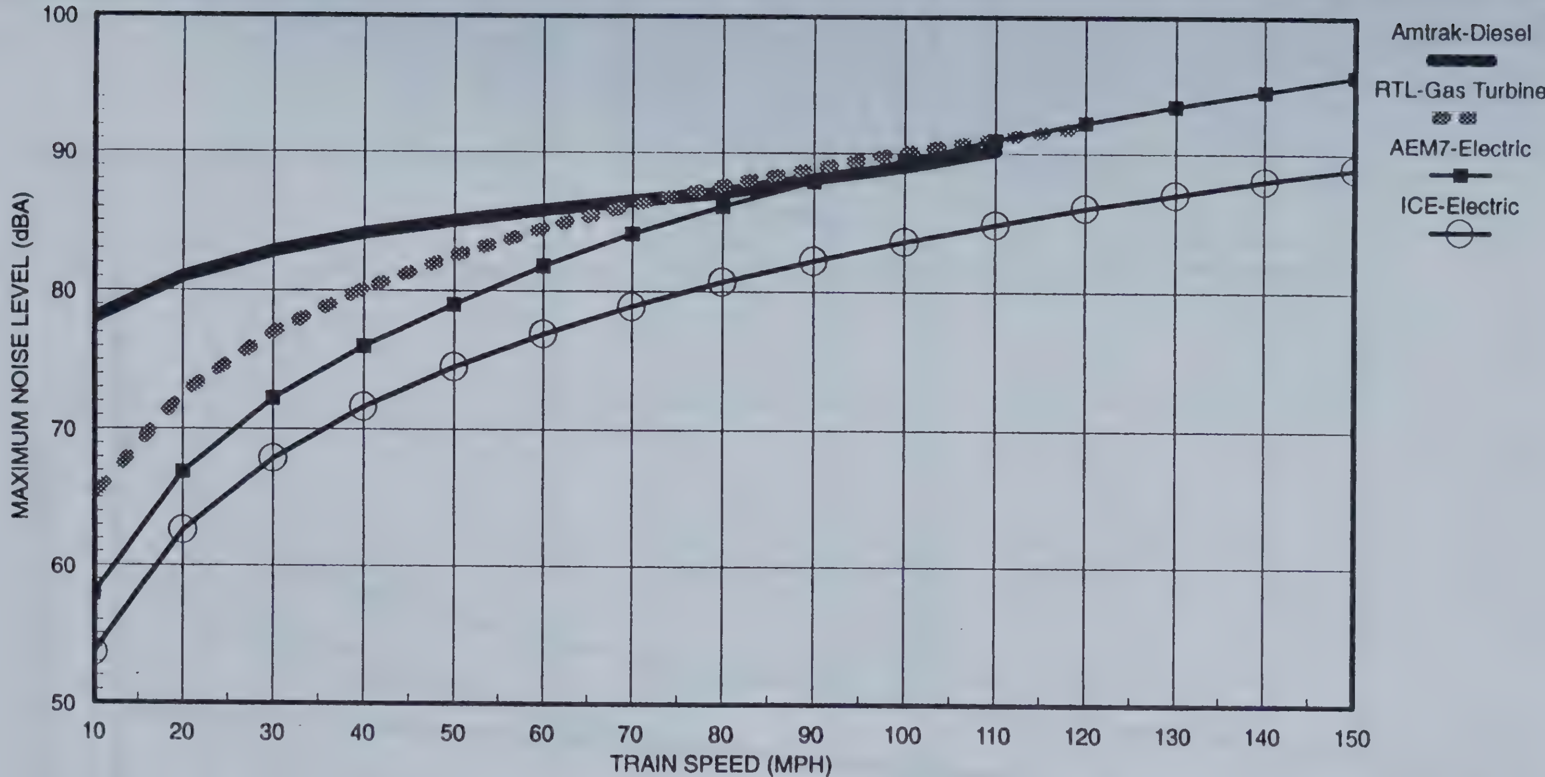
4.4.4 Impacts

Traffic noise increases in the vicinity of the railroad stations are not projected to exceed the 5 dBA evaluation criterion during the peak hour. Of the remaining categories of potential noise and vibration impacts, noise and vibration from train movements are projected to have the greatest potential long term impacts. Vibration from the Proposed Action and the No-Build Alternative scenarios is not projected to result in any building damage to historic or other structures.

For short-term impacts, noise from construction-related activity both along the track and at the electrification facility sites is expected to have substantially less effect along the corridor than train noise. In many instances, construction activity at any one location is relatively brief. For example, bridge undercutting and catenary installation activities are expected to last less than 4 days at any one location and therefore do not exceed the 30-day impact threshold.

Projected Train Noise Levels at 100 ft

(1 Loc. + 8 Pass. Cars or 30 Frt. Cars)*



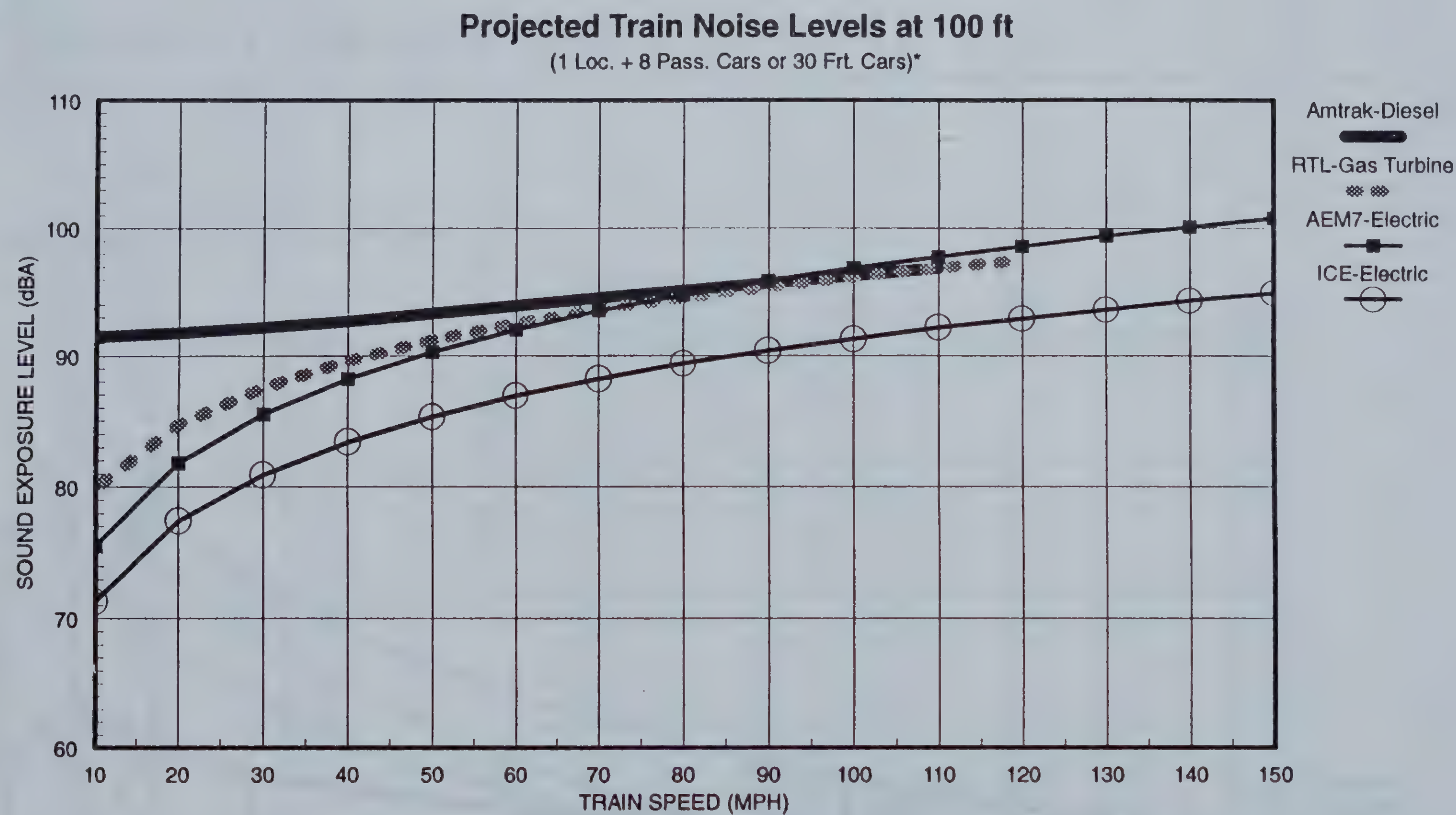
*Except for RTL consist = 2 Loc. + 7 Pass. Cars

Source: HMMH

PROJECTED L_{max} FOR TRAINS AT 100 FT

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 4.4-1



*Except for RTL consist = 2 Loc. + 7 Pass. Cars

Source: HMMH

PROJECTED SEL FOR TRAINS AT 100 FT

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure
4.4-2

4.4.4(a) Environmental Impacts

Train Noise. A corridorwide inventory of train noise impact is provided in Table 4.4-4. This table indicates the estimated number of residences located within the noise impact zones for the range of build scenarios from Initial to Worst Case in addition to the No-Build Alternative - AMD-103 and FF-125 scenarios. The results indicate minimal noise impact for the Initial Build scenario, with only 14 residences located within the zone of significant impact. For the other build scenarios, noise impacts are projected at a minimum of 826 residences for the Best Case Build scenario and at a maximum 2,243 residences for the Worst Case Build scenario. Noise impacts for the No-Build Alternative - AMD-103 Scenario are expected to occur at 67 residences. Impacts for the No-Build Alternative - FF-125 Scenario are expected to occur at 1,486 residences, in the middle of the range of the three build scenarios. Impacts for the No-Build Alternative - FRA-150 Scenario, given the projected noise performance standards envisioned for this technology, would be generally those associated with the Best Case Build scenario. Minimization of noise emissions is a major part of FRA's proposed program to develop this high-speed non-electric technology. [This assumes that the non-electric engines can be muffled such that they are as quiet as the X2000 and ICE trainsets at lower speeds.]

The No-Build Alternative - FF-125 Scenario, the Best Case Build scenario, and the Worst Case Build scenario would also impact Caulkins Park in New London, CT; Bluff Point State Park in Groton, CT; and the Second Congregational Church in Attleboro, MA. The Initial Build scenario would have a minor impact to Caulkins Park and Bluff Point State Park but would not affect the use of the park. These noise impacts would be addressed through the mitigation identified in Chapter 5.

Of note is a comparison of noise-impacted properties in the Best Case and Worst Case Build scenarios. The Worst Case scenario represents the current electric locomotive technology in operation along the electrified portion of the NEC; the Best Case scenario represents the newer state-of-the-art technology now utilized in Europe and elsewhere. The difference in number of noise-impacted residences between these two build scenarios, 1,417 residences, highlights the relevance of the NEC trainset purchase program now in progress, in which 26 modern trainsets are to be acquired for high-speed passenger rail service.

Tables detailing the impacts by milepost of the No-Build Alternative scenarios and the three build scenarios of the Proposed Action are contained in Chapter 4 of Volume II of the FEIS/R. Each table also lists the corresponding impact distances for each affected area.

Electrification Facility Noise. The primary sources of noise at the electrification facilities would be transformers and ventilation equipment associated with the Proposed Action. Noise from 12 of the 25 proposed facilities may exceed the impact threshold at a total of 75 residences (see Table 4.4-5).

Train Vibration. The major source of train vibration is the rolling interaction of the train wheels on the track rail, and the vibration resulting from this interaction increases with greater speeds. This factor, combined with the increased frequency of the intercity service (from 20 to 52 trains daily), could result in a greater total dose of vibration energy at a given location over a 24-hour period. The train vibration impact areas were delineated using the vibration projection model to estimate future vibration levels on individual segments of the corridor and determine the distances at which the evaluation thresholds would be reached. The number of vibration-sensitive receptors located within the impact area were then counted using land use maps and aerial photographs of the corridor.

TABLE 4.4-4 Corridorwide Train Noise Impact Inventory

MUNICIPALITY	# RESIDENCES IN IMPACT ZONE				
	NO-BUILD		BUILD		
	AMD-103	FF-125	Initial	Best Case	Worst Case
New Haven	0	0	0	0	4
East Haven	0	0	0	0	0
Branford	0	31	0	5	37
Guilford	0	38	0	3	69
Madison	0	27	0	9	52
Clinton	0	7	0	6	26
Westbrook	0	11	0	7	11
Old Saybrook	0	6	0	2	9
Old Lyme	0	54	1	37	57
East Lyme	0	76	0	11	71
Waterford	0	9	0	0	11
New London	0	20	0	0	20
Groton	0	54	0	8	25
Stonington	0	91	0	54	139
TOTAL CT	***0***	***424***	***1***	***142***	***531***
Westerly	0	16	0	2	15
Hopkinton	0	0	0	0	0
Charlestown	0	20	0	6	20
Richmond	0	28	0	6	28
South Kingstown	17	25	6	45	58
Exeter	0	10	0	7	13
North Kingstown	7	70	0	41	89
East Greenwich	3	77	2	32	80
Warwick	40	360	3	252	412
Cranston	0	14	0	0	0
Providence	0	4	0	4	4
Pawtucket	0	11	0	1	11
Central Falls	0	11	0	0	11
TOTAL RI	***67***	***646***	***11***	***396***	***741***
Attleboro	0	185	1	155	336
Mansfield	0	112	0	77	195
Foxborough	0	9	0	9	63
Sharon	0	5	0	5	56
Canton	0	22	0	16	56
Westwood	0	0	0	0	0
Dedham	0	19	0	5	36
Boston	0	64	1	21	229
TOTAL MA	***0***	***416***	***2***	***288***	***971***
TOTAL CORRIDOR	***67***	***1,486***	***14***	***826***	***2,243***

Source: HMMH, 1994

TABLE 4.4-5 Potential Noise Impacts from Electrification Facilities

ELECTRIFICATION FACILITY AND MUNICIPALITY	NO. OF RESIDENCES IN POTENTIAL IMPACT ZONE
Branford Substation, Branford, CT	1
Leetes Island Paralleling Station, Leetes Island, CT	1
Grove Beach Paralleling Station, Grove Beach, CT	15
Westbrook Switching Station, Westbrook, CT	1
New London Substation, New London, CT	2
Noank Paralleling Station, Noank, CT	5
State Line Paralleling Station, State Line, CT	5
Warwick Substation, Warwick, RI	34
Attleboro Paralleling Station, Attleboro, MA	2
Norton Switching Station, Norton, MA	1
East Foxboro Paralleling Station, East Foxboro, MA	2
Readville Paralleling Station, Readville, MA	6
ALL LOCATIONS	**75**

Source: HMMH, 1994

The results project a total of 1,255 residences within the impact zone for the Initial Build scenario; 1,390 for the Best Case Build scenario; 4,269 for the Worst Case Build scenario; 369 for the No-Build Alternative - AMD-103 scenario; and 746 for the No-Build Alternative - FF-125 Scenario. Impacts for the No-Build FRA-150 alternative, given the projected vibration performance standards envisioned for this technology, would be generally those associated with the Best Case Build scenario. [This assumes that these trains can be designed with wheel sets and suspensions with vibration impacts similar to the X2000 trainset.] The impacted residences by community are tabulated in Table 4.4-6. The impacts identified involve annoyance of residents. No structural impacts are anticipated.

Of note in Table 4.4-6 is the number of impacted residences in Massachusetts for the No-Build Alternative - FF-125 Scenario as compared to similar data for the build alternatives, particularly the Worst Case Build alternative. Although train operations under the No-Build Alternative - FF-125 Scenario and Worst Case Build alternative are assumed to generate the same vibration levels at any given speed, the speed assumptions are different for these two cases. The Worst Case Build alternative assumes speeds up to 120 mph for conventional trains and up to 150 mph for express trains, while the No-Build Alternative - FF-125 Scenario assumes speeds up to 120 mph for all trains. The greater maximum speed under the Worst Case Build alternative results in significantly greater impacts in Massachusetts for this alternative as compared to the No-Build Alternative - FF-125 Scenario.

The Best Case Build scenario impacts one church in Charlestown, RI, and the Worst Case Build scenario impacts two churches in Stonington, CT, and Charlestown, RI, and four schools in Boston, MA. The No-Build Alternative - FF-125 Scenario also is projected to impact two churches located in the communities of Stonington, CT, and Charlestown, RI.

Detailed tables indicating the milepost locations of all vibration-impacted properties for all build scenarios and No-Build Alternative scenarios are contained in Chapter 4 of Volume II of the FEIS/R.

TABLE 4.4-6 Corridorwide Train Vibration Impact Inventory

MUNICIPALITY	# RESIDENCES IN IMPACT ZONE				
	NO-BUILD		BUILD		
	AMD-103	FF-125	Initial	Best Case	Worst Case
New Haven	0	12	0	0	19
East Haven	0	0	0	0	0
Branford	0	3	0	0	17
Guilford	0	0	0	0	0
Madison	0	0	0	0	29
Clinton	0	0	0	0	15
Westbrook	0	0	0	0	15
Old Saybrook	0	0	0	0	2
Old Lyme	0	20	0	10	20
East Lyme	0	57	0	21	59
Waterford	0	7	0	3	7
New London	0	12	0	8	16
Groton	0	13	0	8	14
Stonington	0	73	0	50	97
TOTAL CT	***0***	***197***	***0***	***100***	***310***
Westerly	0	9	0	6	11
Hopkinton	0	0	0	0	0
Charlestown	0	9	0	0	10
Richmond	0	21	0	16	24
South Kingstown	4	8	3	4	13
Exeter	0	0	0	0	0
North Kingstown	59	25	11	11	33
East Greenwich	32	50	29	29	51
Warwick	231	232	192	192	254
Cranston	0	0	0	0	0
Providence	5	4	4	4	6
Pawtucket	0	3	0	0	4
Central Falls	38	26	0	12	36
TOTAL RI	***369***	***387***	***239***	***274***	***442***
Attleboro	0	95	0	0	180
Mansfield	0	4	0	0	56
Foxborough	0	0	0	0	13
Sharon	0	0	0	0	26
Canton	0	19	0	0	67
Westwood	0	0	0	0	0
Dedham	0	44	0	0	45
Boston	0	0	1016	1016	3130
TOTAL MA	***0***	***162***	***1,016***	***1,016***	***3,517***
TOTAL CORRIDOR	***369***	***746***	***1,255***	***1,390***	***4,269***

Source: HMMH, 1994

4.4.4(b) Construction Period Impacts

Noise Impacts. For the Proposed Action, the effects of construction noise would occur intermittently and would be of limited duration, ranging from 1 to 4.5 months for the bridge modifications, and from 2 to 4 months for the electrification facilities. Such noise would occur only during weekdays and during daylight hours, and could exceed the impact thresholds at three of the 25 facility sites and three of the seven bridge modifications. The number of impacted residences, totaling 28, are noted in Table 4.4-7. Construction noise from bridge undercutting and catenary installation is expected to last less than 4 days at any one location and therefore would not exceed the impact threshold.

The primary source of construction noise is construction equipment and, in the case of the bridge raising and replacements, pile driving. For the electrification facilities, construction machinery likely would include the types of equipment typically used for light industrial construction, such as graders, bulldozers, backhoes, cranes, and trucks. For the bridge raising or replacements, machinery would include heavy-duty construction equipment, such as large cranes, trucks, jacks, and material handling equipment. Based on the construction activities and equipment, it was determined that the distance from the construction sites at which the 75 dBA impact criteria would be exceeded is 180 feet for electrification facilities, 140 feet for bridge raisings, and 280 feet for bridge replacements.

Given that no facility construction is associated with the No-Build Alternative scenarios, there would be no construction-related noise impacts.

Vibration Impacts. For the Proposed Action, project-generated construction vibration impacts are expected to be relatively minor. Catenary installation and bridge undercutting are expected to last no more than a few days at any one location, and therefore construction vibration from these activities would not exceed the impact threshold. Construction-generated vibration that would exceed the impact thresholds would be limited to small areas around one of the 25 electrification facilities and three of the bridge modifications. While a total of 16 residences fall within the impact area for vibration at these sites (see Table 4.4-8), the construction would take place intermittently and be of limited duration, ranging from 1 to 4.5 months at the bridge sites and approximately 2 to 4 months at the facility sites. In addition, the construction would be limited to weekday, daylight hours.

Given that no facility construction is associated with the No-Build Alternative scenarios, there would be no construction-related vibration impacts.

TABLE 4.4-7 Potential Construction Noise Impacts

PROJECT FACILITY OR BRIDGE AND MUNICIPALITY	DISTANCE OF IMPACT (in feet)	DURATION OF CONSTRUCTION (in months)	NO. OF RESIDENCES POTENTIALLY AFFECTED
Warwick Substation, Warwick, RI	180	4	5
Leetes Island Paralleling Station, Branford, CT	180	2-3	1
Grove Beach Paralleling Station, Branford, CT	180	2-3	2
Johnnycake Hill Road Bridge, Old Lyme, CT	280	1	1
Kenyon School Road Bridge, Richmond, RI	280	3	7
Pettaconsett Avenue Bridge, Warwick, RI	280	4.5	12

Source: HMMH, 1994

TABLE 4.4-8 Potential Construction Vibration Impacts

PROJECT FACILITY OR BRIDGE AND MUNICIPALITY	DISTANCE OF IMPACT[1] (in feet)	DURATION OF CONSTRUCTION (in months)	NO. OF RESIDENCES POTENTIALLY AFFECTED
Grove Beach Paralleling Station, Branford, CT	85	2-3	2
Johnnycake Hill Road Bridge, Old Lyme, CT	210	1	1
Kenyon School Road Bridge, Richmond, RI	210	3	6
Pettaconsett Avenue Bridge, Warwick, RI	210	4.5	7

Notes: [1]Category 2 distances are used, since all potentially affected land uses are residences.

Source: HMMH, 1994

4.5 ELECTROMAGNETIC FIELDS AND INTERFERENCE

This section addresses two types of potential effects from EMF: health effects and interference with local communications systems (e.g., police, fire, television, radio). Magnetic field exposure results from any current traveling through a wire or electrical device; electric fields are related to voltage. As a result, everyone is almost continuously exposed to EMF, although the intensities of exposure vary widely over time, depending on proximity to electrical devices and wiring. Only the magnetic field intensity values were evaluated because the electric field component of EMFs are largely shielded by vegetation, walls, and fences. The EMF guidelines and levels are presented in milliGauss, which is a unit of measurement of magnetic field intensity. The intensity of earth's static magnetic field is approximately 500 mG in the northeastern United States.

As only the Proposed Action would involve the installation of an electrification, the EMF issue is unique to this alternative. Thus, the No-Build Alternative scenarios would not increase opportunities for EMF exposure beyond those now existing EMF.

4.5.1 Summary of Studies and Research Findings

This section provides a brief summary and evaluation of existing studies and recent research regarding the potential health effects of EMF and the electromagnetic interference to communication systems from electrified train lines.

In response to comments received on the DEIS/R, further review of the current literature on potential impacts of EMF on children; on occupational exposures; and on fish migration is included in the evaluation. These studies are discussed in greater detail in Chapter 5, Volume II, of the FEIS/R, and supplement information presented in the DEIS/R on the effects of EMF.[7]

In summary, there have been several recent epidemiological studies of residential and occupational exposures to EMF. Some of these studies have shown a weak association between EMF exposures and other have not. Laboratory studies on humans, animals and cells have also been performed over a wide range of EMF intensities. On balance, however, the epidemiologic and laboratory studies have yet to provide sufficient evidence of adverse

health effects, or a confirmed mechanism to explain how hypothetical health effects might occur, to lead to a consensus that exposures to EMF at levels normally found in the environment are associated with adverse health effects. The present state of scientific knowledge is still insufficient to serve as a basis for regulations or guidelines limiting emissions of and public and work place exposures to EMF.

4.5.1(a) Public Health and Childhood Impacts

In studies of residential exposures to EMF, some researchers have reported associations between higher magnetic fields and childhood leukemia while others have found no such associations. In several studies in which EMF exposures are estimated by characterizing the type of utility wiring outside the home and the distance of the line from residences, or by calculating the EMF levels based on the current flowing in nearby power lines, it has been reported that estimated magnetic field exposures of children with leukemia are higher than those in residences of other children. In contrast, other methods of estimating magnetic field exposure based upon field levels actually measured within a child's residence have not yielded any reliable associations with leukemia or other cancers. Therefore, the "dose" metrics for potentially harmful EMF exposure are not defined. The shortcomings and contradictory results of these and other studies, however, preclude any definitive interpretation at this time regarding their significance for human health. Studies of adults have not conclusively supported the suggested association between cancer and estimated magnetic field exposures.

4.5.1(b) Occupational Health

Epidemiological research has also looked for associations between occupations presumed to have greater than average exposures to magnetic fields and cancer. No differences in health were found in studies of workers on electrified railroads in Norway, Sweden, Japan, or Italy. Workers on electrified railroads overall have not been consistently shown to be at elevated risk for brain cancer, or leukemia.

In summary, there is currently no consensus in the scientific community that there is conclusive evidence of a causal link existing between EMF exposures and health concerns.

4.5.1(c) Fish Migration

There has been ongoing interest in the possibility that exposure to manmade EMF could alter an organism's ability to navigate. Marine organisms reportedly are able to orient themselves with geomagnetic cues. In addition to reports that indicate that some marine animals are able to detect magnetic fields, it has been well documented that weak electric fields can also be detected by certain fish, which in turn use them as a means of orientation and prey location. Although the understanding of the mechanisms used by animals to assist in navigation is far from complete, the available literature does not suggest that 60 Hz fields such as those associated with overhead AC transmission lines or underwater cables would impact marine species at crossings.

4.5.1(d) Wildlife

Several comments on the DEIS/R raised questions regarding the potential impact of EMF on wildlife. While the potential for exposure of wildlife to EMF generated by the proposed electrification is relatively limited, there are certain locations along the NEC in which exposure of wildlife could occur. Therefore, existing research on EMF impacts on wildlife was reviewed, and is summarized below.

Most research on wildlife has focused on possible alterations in foraging and migration patterns and, although there are a limited number of studies, no effects attributable to electric and magnetic fields have been found. Recent relevant research includes ongoing studies of exposures to electric and magnetic fields from a 76Hz communications system in Wisconsin and Michigan which have reported no adverse effects on wildlife. These studies analyzed the homing behavior of small animals and birds, the metabolism of small birds, and the population size of birds and deer.[8]

In addition to studies in the wild, studies of domestic livestock and studies of laboratory animals are relevant for assessing the possible effects of exposure to electrical and magnetic field of wildlife. For example, in a 2-year study on 11 livestock farms near a transmission line, Amstutz and Miller reported that neither health, behavior, or performance of farm animals (horses, sheep, swine, dairy, and beef cattle) were affected.[9] Stormshak et al.

studied sheep exposed over a year to electric and magnetic fields produced by a transmission line and concluded that these electric and magnetic fields did not interfere with weight gain, wool production, behavior, or the secretion of the hormone melatonin.[10]

A substantial amount of laboratory research has been conducted in various species of mammals to determine whether exposure to 60 Hz electric and/or magnetic fields could adversely affect the animals' ability to reproduce. Research studies have included in utero exposure and/or exposures prior to conception to study embryonic, fetal, or postnatal development. In studies repeated by different researchers and in different species, no adverse impact has been reported on reproductive fitness, fertility, or on the growth, development, or survival of the offspring.[11]

4.5.1(e) Radio Interference and EMI

The Japanese railway system has had high-speed electrified rail systems in operation for over 20 years and it has devoted considerable attention over that time period to the reduction of radio interference from train systems. The conclusion arising from these efforts is that the principal source of interference is from a breakdown of the connection and connective arc between the pantograph and the overhead catenary line.[12] The most effective mitigation measure employed was a reduction in the number of pantographs. Also, the use of higher voltages, such as 25 kV, which is the voltage of the proposed system, minimizes the breakdown of the connection and therefore minimizes the resulting interference. Arcing, itself, is not a cause of interference, rather it is the collapse and reestablishment of the arc that causes radio frequency emissions.[13]

4.5.1(f) Research Efforts of the Federal Railroad Administration

Advanced Maglev and electrified high-speed rail technologies, such as the Proposed Action, have been proposed for U.S. demonstration and applications in selected high-density corridors. Under the Federal Railroad Safety Act of 1970, FRA is responsible for identifying and assessing potential safety hazards associated with these advanced rail systems and operations, and with developing appropriate safety requirements and regulations to address any identified hazards.

Since the public was particularly concerned about the exposure to EMF and corresponding health effects from the implementation of these systems, FRA established an EMF research and development program in 1990. The goals of this EMF program were to: (1) characterize EMF emissions associated with high-speed electrified rail and Maglev; (2) identify and assess potential health and safety effects; and (3) determine potential EMF control and mitigation options. As part of this program, FRA formed multi-year interagency agreements with EPA Office of Radiation Programs and the Department of Energy's Argonne National Laboratory for technical support with biological and environmental issues.

The EMF characteristics of the proposed high-speed rail and Maglev systems were compared with existing transit and electrified rail systems and with other common environmental, home, work, and office EMF sources. To date, FRA has expended over $1.8 million for direct EMF measurements and studies of associated safety and health impacts on existing electrified systems throughout the U.S. and in Europe. Twelve reports were published, and their results reviewed and incorporated into this FEIS/R, as appropriate.[14]

Congress has acknowledged the value of program findings to date and directed FRA to continue monitoring national and international EMF research and to be ready to institute exposure limits if the scientific community reaches consensus on a causal link between low frequency EMF exposure and adverse health effects. The current focus of FRA's research is on engineering design, performance, and options analysis for cost-effective EMF exposure reduction, management or mitigation. For example, the 2 x 25 kV design proposed by Amtrak reduces EMF generation by using two parallel catenary wires with current running in opposite directions so that much of the EMF generated is cancelled. This technique is known as phase cancellation.

4.5.2 Evaluation Criteria

As described above, epidemiological and biological studies undertaken to determine if any link exists between EMF exposure and health impacts have not provided sufficient evidence to conclude that EMF adversely affects health. As a result, regulations regarding EMF exposure have not been promulgated by the Federal government or by any states. Florida and New York have issued guidelines for maximum EMF field intensities associated with transmission lines, and a number of national and international agencies have suggested interim guidelines for EMF exposure. The two state guidelines and the national and international interim guidelines have been adopted as evaluation criteria in this report; they are summarized in Table 4.5-1. The two state guidelines are designed to limit emissions from new facilities, but clearly state that they are not based on conclusions regarding the potential health impacts of EMF. There are no applicable evaluation criteria for electromagnetic interference.

4.5.3 Impacts

4.5.3(a) Health Impacts

Environmental Impacts.

Human: Since there is no established link between EMF exposure and public health effects at levels commonly encountered in the environment, this analysis estimates the increase in EMF levels likely to be experienced by various categories of potentially impacted persons. These levels will then be compared to the established guidelines.

In this analysis, the population potentially exposed to EMF from the NEC electrification project was subdivided into a number of categories, and the level of EMF exposure was estimated for each population category. The population is subdivided in three ways. The first is based on the duration and type of exposure: environmental, occupational, and occasional. Environmental exposures include those that are the longest in term (e.g., associated with living near the ROW). Occupational exposures are those that occur while working (e.g., working along the ROW or on the trains). Occasional exposures represent those that occur intermittently (e.g., from using a park near the ROW). The second set of categories is based on physical location, and includes categories in proximity to the ROW, substations, and utility lines, as well as passengers on intercity trains. For some of the locational categories, these were broken down further, into zones, based on distance from the source. Zone 1 was defined as 0 to 50 feet from a source, Zone 2 as 50 to 100 feet, and Zone 3 as 100 to 150 feet from the source. Based on EMF measurements from existing electrified rail systems, the EMF levels drop off to background by 150 feet from a source, so areas beyond this distance were not considered. Table 3.5-1 provides a summary description of the population categories to EMF exposure levels for each population type; and Table 3.5-2 provides an estimate of the number of persons contained in each population category.

Table 4.5-2 shows each of the population categories, including their locational and exposure attributes, the applicable interim guidelines for each category, and the estimated level of EMF exposure. There are three populations that would receive extended exposures to increased EMF levels, residents and employees of commercial establishments located adjacent to the rail line, and railroad employees. With regard to the first two populations, EMF exposure estimates range from 1.5 to 9.3 mG within 50 feet of the rail line (Zone 1), the area of greatest increase. The potentially exposed population in this area includes 300 residents and 2,800 employees of commercial or industrial establishments. The estimated EMF exposures range from 2.2 to 13.5 mG within 50 feet of substations or utility tie-ins (Zone 1). The potentially exposed population in this area includes 37 residents and 12 employees of commercial or industrial establishments..

With regard to the estimated 250 on-board Amtrak and ConnDOT rail employees, EMF exposure levels would range from 2.7 to 26.2 mG in coaches, and from 21.7 to 134 mG in locomotives. With regard to the estimated 560 off-train yard, track, building, and structure maintenance employees, estimated EMF levels would range from 4.1 to 37 mG. And, with regard to the 160 estimated station and management employees, estimated EMF levels would range from 16 to 209 mG.

None of these anticipated levels of exposure to EMF would exceed the existing applicable guidelines. Rather, in most instances the estimated levels of exposure are one one-hundredth (0.01) to one one-thousandth (0.001) of these guidelines, and in no case is the estimated exposure level greater than four one-hundredths (0.04) of the applicable guideline.

Fish Migration: Concern has been expressed that EMF could affect the migration of fish in four rivers and one cove where there would be submarine cables carrying power for the proposed electrification project. Submarine cables would be installed at five moveable bridges crossing the Connecticut, Thames, Niantic, and Mystic rivers, and Shaw's Cove. The submarine cables would function as the feeder cable, as well as maintain full current flow along the traction circuit during the times that the bridges are open to allow the passage of river traffic. During normal operations, the moveable bridges are closed when trains are operating in their vicinity. At these times, current flow would apportion itself between the catenary and the submarine cable, so that there would always be current flowing through the cable when a train activates the local section of the catenary.

The submarine cables would not be a source of electric field exposure to fish and other aquatic organisms because of shielding by the metal anchor covering the cable. Hence, the only potential field exposure of significance would be magnetic. The magnetic field intensities fall off with distance from the submarine cable (see Figure 4.5-1). This figure can be used to estimate the instantaneous maximum magnetic field exposure likely to be encountered at the moveable bridge crossings during short-duration, peak power loadings. When the bridge is closed, these values will be approximately halved (to account for current apportioned between the catenary and the cable).

No impact to fish migration is expected from EMF for two reasons. First, the assumed sensitivity of fish to magnetic fields for navigation is to direct current (DC) magnetic fields, not 60 Hz magnetic fields. Second, analyses and calculations made by Adair[15] and Kirschvink et al.[16] suggest that it is unlikely that detection of 60 Hz AC fields by mechanisms based upon magnetite would operate at field strengths less than 50 mG. Such field strengths would not be encountered at distances greater than 10 feet from the cable or 3 feet above the bottom of the channel (the cable would be buried 7 feet below the channel bottom). As shown by Figure 4.5-1, the maximum estimated magnetic field intensity at 10 feet above the submarine cable is approximately 42 mG (based on 599 amps, the maximum design load on the cable). If fish swim close to the field, they will have an opportunity to swim above the perceived field, in order to avoid field strengths greater than 50 mG. Furthermore, none of the proposed submarine cables would span more than half the width of the water body being crossed, thus leaving the major portion of water bodies exposed to only the very low magnetic field intensities resulting from the catenary systems. Finally, the expected average magnetic field intensity (at 166 amps, the average load in the cable during Amtrak operations) 10 feet above the cable would be on the order of 12 mG while the bridge is open and 6 mG while it is closed (far less than 50 mG), the latter condition being its predominant configuration.

Safety From Possible Electromagnetic Induction Currents: Amtrak performed a study[17] to analyze potential EMF safety issues from electromagnetic induction which includes both inductive and capacitive coupling effects. This type of effect could cause malfunction or damage to equipment located close by, or represent danger for persons. A screening concept was developed to identify potentially affected objects/utilities along the catenary system for further detailed analysis. The results of the screening study provided limiting exposure lengths for the close by communication and signaling circuits, underground and above-ground pipes, large objects, and fences. Companies along the railroad were identified and contacted to gather site specific information. Also, a site survey was initiated to locate large objects and long fences along the railway. Although the analysis was considered to be conservative, it indicated that there could be an impact from induced voltages to long and parallel structures, such as fences and guardrail. Conservative estimates show that within the right-of-way and up to 500 feet from the catenary, all fences and guardrail longer than 600 feet should be grounded. Beyond 500 feet of the catenary, up to a mile, no grounding is required unless fences and/or guardrail are longer than 1,200 feet. No fences and other metallic installations need to be grounded beyond 1 mile from the catenary. Underground uncoated pipes are not expected to create safety concerns, since there is an almost continuous connection to the earth.

TABLE 4.5-1 Evaluation Criteria for EMF Emissions

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Level of EMF Exposure	Florida DER[1] Guideline for Edge of Right-of-Way of Transmission Line	150 mG[2] for $\leq$ 230 kV 200 mG for $\leq$ 500 kV 250 mG for $\leq$ 500 kV, closed circuit
	New York SPSC[3] Guideline for Edge of Right-of-Way of Transmission Line	200 mG for $\geq$ 345 kV
	ACGIH[4] Interim Guideline for Occupational Exposure	10,000 mG for 60 Hz
	CDRH/FDA[5] Interim Guideline for General Exposure	5,000 mG for static field
	IRPA/INIRC[6] Interim Guideline for: 24 hr/day Public Exposure Whole Day Occupational Exposure Few Hours Occupational Exposure	 1,000 mG for 50-60 Hz 5,000 mG for 50-60 Hz 50,000 mG for 50-60 Hz
	NRPB[7] Interim Guideline for General Exposure	2,000 mG for < 100 Hz
	DIN[8] Interim Guideline for General Exposure	46,000 mG root-mean-square[9] amplitude for 50 Hz 69,000 mG peak amplitude for 50 Hz

Notes: [1]Florida Department of Environmental Regulation.
[2]mG - milliGauss
[3]New York State Public Safety Commission.
[4]American Conference of Governmental and Industrial Hygienists.
[5]Center for Devices and Radiologic Health of the Food and Drug Administration.
[6]International Non-Ionizing Radiation Committee of the International Radiation Protection Association.
[7]National Radiological Protection Board (Great Britain).
[8]Deutsche Elektrotechnische Kommission (Germany).
[9]Root-mean-square is a procedure for averaging data.

Source: Roy F. Weston, Inc., 1993

TABLE 4.5-2 Comparison of Estimated EMF Exposure Levels with Interim Guidelines

POPULATION TYPE	RESIDENTIAL	COMMERCIAL/ INDUSTRIAL	RECREATIONAL	AMTRAK & CONNDOT EMPLOYEES	MBTA & FREIGHT EMPLOYEES	RAIL PASSENGERS
Exposure Type	Environmental	Occupational	Occasional	Occupational	Occasional	Occasional
Relevant Interim Guideline (mG)[1]	1,000 - 46,000	5,000 - 50,000	5,000 - 46,000	5,000 - 50,000	5,000 - 46,000	5,000 - 46,000
Location[2,3]	**Range of Magnetic Field Level (mG)**	**Range of Magnetic Field Level (mG)**	**Range of Magnetic Field Level (mG)**	**Range of Magnetic Field Level (mG)**	**Range of Magnetic Field Level (mG)**	**Range of Magnetic Field Level (mG)**
Wayside				Amtrak & ConnDOT employees would not be considered part of the population at these locations[1]	MBTA & freight employees would not be considered part of the population at these locations[1]	Rail passengers not considered to be part of the population at these locations[2]
Zone 1	1.5 - 9.3	1.5 - 9.3	1.5 - 9.3			
Zone 2	0.4 - 1.5	0.4 - 1.5	0.4 - 1.5			
Zone 3	0.2 - 0.4	0.2 - 0.4	0.2 - 0.4			
Substation			No recreational use is anticipated at substations, utility lines, or on trains, therefore recreational exposure does not occur at these locations			
Zone 1	2.2 - 13.5	2.2 - 13.5				
Zone 2	0.5 - 2.2	0.5 - 2.2				
Zone 3	0.2 - 0.5	0.2 - 0.5				
Utility Line						
Zone 1	5.5 - 13.0	5.5 - 13.0				
Zone 2	3.0 - 5.5	3.0 - 5.5				
Zone 3	2.0 -3.0	2.0 -3.0				
Electrified Train	Exposure of residents does not occur on trains or at stations	No commercial or industrial use is expected on trains, therefore this population group would not be exposed				
On-Train (Coach)				2.7 - 26.2		2.7 - 26.2
On-Train (Loco.)				21.7 - 134		N/A
Off-Train				4.1 - 37.0		16 - 209
Station				16 - 209		
Diesel Train				[1]		
On-Train					4.1 - 37.0	4.1 - 37.0
Off-Train					4.1 - 37.0	N/A

Notes: [1]Range of magnetic field levels suggested in various interim guidelines.
[2]Zone 1 = 0 - 50 feet from a source; Zone 2 = 50 - 100 feet from a source; and Zone 3 = 100 - 150 feet from a source.
[3]Range of magnetic field levels estimated from measurements of existing facilities.
N/A = Not Applicable

Source: Roy F. Weston, Inc., 1994

Underground coated pipes could present a safety concern at valves, instrument test/measurement points, and service lines if not grounded. Above-ground pipes could present a safety issue if not properly grounded. The impact from EMF would not be a concern for metal storage tanks and buildings along the NEC from the Proposed Action. Mitigation of these potential impacts is included in Chapter 5. The details of the study are provided in Section 5.7, Volume II, of this FEIS/R.

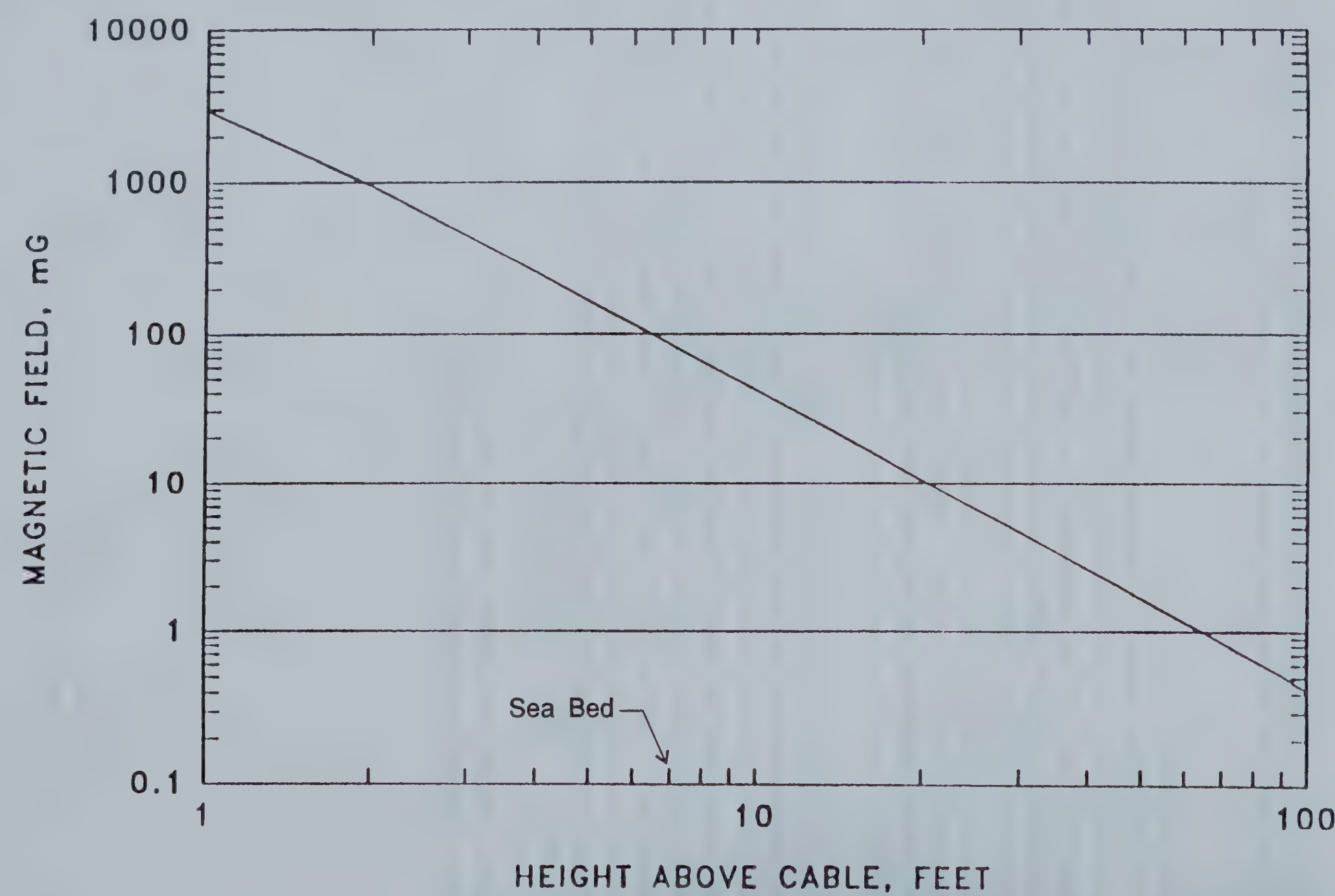
Construction Impacts. The overhead catenary wire would not be energized during construction. Thus, no EMF would be emitted during construction of the Proposed Action and no construction period impacts would be anticipated.

4.5.3(b) Communications Impacts

Environmental Impacts. For radio interference, the potential impacts were assessed by examining previous experience with electrified train lines. In the absence of any relevant evaluation criteria, the Federal Communications Commission (FCC) and the Communications Division of the U.S. Coast Guard were contacted to determine if the existing electrified section of the NEC has been a source of radio communications interference. The Coast Guard reported that although it uses high frequency (HF), very high frequency (VHF), and ultrahigh frequency (UHF) communications equipment, it had not experienced any interference as a result of the existing electrified rail line between New York and New Haven.[18] The FCC indicated that it had no knowledge of any interference with radio or television communications resulting from the existing electrified rail line.[19] Section 5.5 in Volume II of the FEIS/R discusses radio frequency impacts in greater detail.

As part of a study[20] performed by Amtrak the potential impact of EMF on local communication systems was examined. A screening concept was developed to identify potentially affected utilities along the catenary system for further detailed analysis. The results of the screening study provided the limiting exposure lengths for communication and signaling circuits near the catenary. Associated companies along the railway were contacted and a site survey was conducted to gather site-specific information. It was estimated through computer simulation that the Proposed Action could have an impact on the phone lines. These simulations are considered to be conservative and there have been no reports of any communication problems with systems along the New Haven and Washington electrified track. Mitigation of these potential impacts is included in Chapter 5. The details of the study are provided in Section 5.7, Volume II, of this FEIS/R.

Construction Period Impacts. Because the catenary wire would not be energized during construction, EMI would not be emitted. Thus, no construction period impacts are anticipated.



Source: Roy F. Weston, Inc.

MAGNETIC FIELD INTENSITY ABOVE SUBMARINE CABLE		Figure 4.5-1
Northeast Corridor Improvement Project Electrification - New Haven CT to Boston MA		

4.6 ENERGY

This section provides a summary of the evaluation of energy benefits and impacts of the Proposed Action and the No-Build Alternative. The evaluation criteria for determining the energy impacts and benefits of the project are shown in Table 4.6-1.

TABLE 4.6-1 Evaluation Criteria for Energy Impacts

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Energy requirements and conservation potential.	Comparison of total, per passenger, and per seat energy use for all modes of travel under each alternative.	None
Production or consumption of energy.	Comparison of energy use for all modes of transportation with energy generating capacity within the NEC under each alternative.	Energy requirements exceed production capacity.
Use of petroleum or natural gas.	Comparison of fuel type used for all modes of transportation under each alternative.	None

Source: Roy F. Weston, Inc., 1993

4.6.1 Benefits

The Proposed Action is more energy efficient than any of the No-Build Alternative scenarios in meeting the intercity transportation needs of the Boston to New York City corridor. Using conservative assumptions about train size, the Proposed Action would consume 4 percent less energy than the No-Build Alternative - AMD-103 Scenario (the base line) and 11 percent less energy than the No-Build Alternative - FF-125 Scenario. This translates into annual petroleum consumption savings of 10.8 million gallons over the AMD-103 Scenario and 20.9 million gallons over the FF-125 scenario. Since 41 percent of all petroleum products used in the United States are imported, the net effect of the Proposed Action would be to reduce American dependence on foreign oil by 4.4 to 8.6 million gallons annually.

Using more realistic assumptions about the size of trains operating under the Proposed Action, the energy consumption for high-speed electric trains when measured on a Btu per seat-mile basis is only slightly higher than for the existing diesel service (885 vs. 834, a 6 percent difference). Thus, significantly faster service can be achieved with only a slight reduction in energy efficiency.

4.6.2 Energy Impacts

4.6.2(a) Projected Energy Consumption for the Proposed Action

Changes from the DEIS/R. In reevaluating the energy consumption of the Proposed Action based on comments received by FRA, two factors were identified that materially affect estimates of energy consumption. The first is an error on the part of FRA. In presenting the energy consumption of electrified operations in the DEIS/R, FRA mistakenly included both the energy requirements of Amtrak intercity trains and those for commuter trains operated by the MBTA should the MBTA decide to convert to electric traction. While the sizing of electric traction facilities to support eventual commuter electrified options is a benefit of this project (see comment MA

2-11.1 in Volume III), it is inappropriate to use commuter energy consumption in an analysis of intercity transportation alternatives. Correcting this error reduces Proposed Action energy consumption by 12 percent.

The second factor affecting energy estimates relates to the size of trains used in the analysis. Amtrak correctly points out that the energy analysis in the DEIS/R used "design" trains. These trains consist of one locomotive and eight cars for express trains and two locomotives and 18 cars for conventional trains. These design trains were used in the design of the electrical facilities to identify the maximum electrical load with an adequate margin of safety. Amtrak maintains that it is extremely unlikely that trains of this size would operate between Boston and New York City. Indeed, there are no platforms adequate to accommodate a train the size of the design conventional train at Boston's South Station. Amtrak plans to operate much shorter trains -- one locomotive and six-car express and one locomotive and eight-car conventional trains. These smaller trains would require less energy.

The use of the design trains results in an inherently conservative analysis -- i.e., it penalizes the Proposed Action -- which is consistent with the general approach taken in preparing this FEIS/R. As a consequence, the following analysis will estimate energy consumption for the Proposed Action and No-Build Alternative - FF-125 Scenario based upon design trains. The following analysis will also estimate energy consumption based upon the more realistic smaller train sizes as well.

During the demonstration of the X-2000 on the NEC in 1993, Amtrak measured the energy used by an express train between Washington and Boston. For this trip, the X-2000 consumed 4,343 kWh with 739 kWh returned through regenerative braking for a projected net take of 3,604 kWh.[21]

At this rate of energy consumption, the X-2000 would consume substantially less energy in the study area than is estimated above for smaller trains. While a number of variables will ultimately influence the energy consumption of electric operations under the Proposed Action, those measurements of modern high-speed equipment in operation demonstrate that the smaller train estimates discussed in this section are relatively conservative and therefore more likely to occur than the large train estimates.

Energy Consumption for Large (Design) Trains. Based upon simulations conducted for Amtrak, the energy consumption at the locomotive of the Proposed Action with the 2010 levels of service is estimated at 455,800 kilowatt-hours (kWh) per day or 166,370 megawatt-hours (MwH) per year.

Fuel Consumption for Electricity Generation: The energy consumption identified above is the electrical energy delivered to the locomotive's transformers. This electricity is generated at power plants and transmitted to the locomotive. The transmission of electricity involves losses from various sources such as line resistance and at transformers. To account for this loss in the analysis of energy impacts, electricity consumption was increased by a factor of 8 percent. This compensation factor is consistent with other studies conducted by utilities. As a consequence 179,680 MwH of electricity must be generated to meet the energy demands of the Proposed Action.

As a base assumption, the fuels used by utilities to generate electricity are assumed to be 50 percent oil and 50 percent natural gas. The rationale for this assumption is presented in Volume III, Section 6.4.3 of the DEIS/R. Using data in the DEIS/R regarding generating efficiency and the heat content of fuel, the annual quantities of oil and natural gas used to generate this electricity were estimated and are presented in Table 4.6-2. This was then translated into British thermal units (Btu) to permit a normalized discussion of energy consumption. The energy required to generate the electricity for the Proposed Action at 2010 service levels totals 1,824 billion Btu. The total passenger-miles and seat-miles traveled under the Proposed Action were also estimated.[22] The resulting energy consumption on a passenger-mile basis is 2,792 Btu and on a seat-mile basis is 747 Btu.

Energy Consumption for Smaller Trains. Based upon simulations conducted for Amtrak using the smaller train size, the energy consumption at the locomotive of the Proposed Action with the 2010 levels of service is estimated at 273,770 kWh per day or 99,925,000 kWh per year. This estimate of energy consumption is 60 percent that for the larger trains.

Fuel Consumption for Electricity Generation for Smaller Trains: Using the same factors used above to translate the energy used by the trains into energy required to generate electricity results in an estimate of the annual generating requirement of 107,808,000 kWh requiring the consumption of 1,094 billion Btu of fuel. This translates into 1,675 Btu per passenger-mile, 60 percent of the level for the larger trains. However, because the smaller trains have fewer seats, the energy consumption per seat-mile is 885 Btu, approximately 20 percent greater than with the larger trains.

TABLE 4.6-2 Summary of Projected Energy Consumption, Proposed Action, 2010

Daily express train electricity consumption	209,488 kWh
Daily conventional train electricity consumption	246,320 kWh
Daily total electricity consumption	455,808 kWh
Annual electricity consumption	166,369,920 kWh
Annual electricity generation required (w/ 8 percent transmission loss/compensation)	179,679,514 kWh
Annual energy input required for electricity generation (based on 10,151 Btu/net kWh)	1,824 billion Btu
Annual oil consumed (based on 50 percent of electricity generated using oil; 150,357 Btu/gallon of oil)	6,065,231 gallons
Annual natural gas consumed (based on 50 percent of electricity generated using natural gas; 1,039 Btu/cubic foot of natural gas)	877,718,961 cubic feet

Source: Roy F. Weston, Inc., 1994

4.6.2(b) Projected Energy Consumption for the No-Build Alternative

No-Build Alternative - AMD-103 Scenario (Baseline). Amtrak has suggested that based on its review of the market and operational needs of intercity service under this scenario, two express trains (round trips) would be added to the 10 trains on the current schedule. This is an increase of one train (round trip) over that used in the energy analysis in the DEIS/R. Amtrak expects that express and conventional trains would consist of one locomotive and six cars.

Energy Consumption of the No-Build Alternative - AMD-103 Scenario: The incremental energy consumption of the additional trips was calculated and added to that for the current schedule. The four additional trips per day would consume 1,052 gallons per day, or 383,980 gallons per year, based on 263 gallons per trip. This results in total diesel consumption of 2,970,735 gallons per year, which translates to 418.9 billion Btu per year.

As calculated in Section 6.4.3.2 of Volume III of the DEIS/R, the base line scenario is projected to result in 295,598,115 passenger-miles per year. Using the energy consumption calculated above, the No-Build Alternative - AMD-103 Scenario consumes 1,417 Btu per passenger-mile. The four additional express trips per day add approximately 59 million seat-miles per year, bringing the total to 496.2 million seat-miles per year. Using these data, this scenario would consume 844 Btu per seat-mile.

No-Build Alternative - FF-125 Scenario. The energy consumption of the FF-125 scenario is based upon the fuel consumption of the gas turbine RTL trainsets presently used by Amtrak on the Empire Corridor of New York State. A simulation of an RTL with tilt capability operating between Boston and New York City was used to obtain fuel consumption on a train-mile and ton-mile basis. The fuel consumption was then adjusted on a ton-mile basis to reflect the train size being used in the analysis.

Energy Consumption for Large Trains: The trains used in this analysis consist of two locomotives and seven cars for express trains and two locomotives and 17 cars for conventional service to be comparable to the large train version of the Proposed Action. Using the same schedule assumed for the Proposed Action, this scenario would consume 20,734,920 gallons per year of diesel fuel which represents approximately 2,924 billion Btu.

Using the 2.84 million in annual ridership projected for the FF-125 scenario (see Section 4.9.1(b)) the energy consumption of this scenario would equal 5,717 Btu per passenger-mile and 1,311 Btu per seat-mile.

Energy Consumption for Small Trains: The trains used in this analysis consist of two locomotives and five cars for express trains and two locomotives and seven cars for conventional service to be comparable to the small train version of the Proposed Action. Using the small train size assumptions, the FF-125 scenario would consume 12,053,760 gallons per year of diesel fuel which represents approximately 1,700 billion Btu. This then translates into 3,324 Btu per passenger-mile and 1,634 Btu per seat-mile.

No-Build Alternative - FRA-150 Scenario. Given the state of FRA's non-electric high-speed locomotive program, it is impossible to calculate the fuel consumption of this scenario. Maximizing energy efficiency will be one of the criteria used in program evaluation. On one hand, the higher speeds would tend to cause greater fuel consumption per train-mile. On the other hand, several persons and firms who may participate in this program point to significant opportunities to improve upon the fuel consumption of non-electric power units presently used in rail applications in the U.S. As an example, Turbomeca, manufacturer of the Mikila gas turbine engine to be demonstrated in 1995 by FRA, Amtrak, and New York State in an upgraded RTL trainset, estimates that this engine will improve fuel efficiency by 15 to 20 percent over the gas turbines presently used in the RTL.

Other prime mover manufacturers and proponents estimate similar or greater fuel efficiencies could be achieved as part of an advanced non-electric locomotive/trainset development program. Whether such efficiencies can be achieved in regular high-speed rail operations will not be known until the development program progresses.

Comparison of Current, No-Build, and Electrification Alternatives. Table 4.6-3 provides a summary of the key aspects of energy consumption for the current schedule of trains, the Proposed Action, and the No-Build Alternative - AMD-103 and FF-125 scenarios. It can be seen that total energy consumption is higher than the current level for all alternatives, as would be expected, given the increased numbers of trains.

Another valid comparison is with the energy efficiency of other modes of transportation. Data compiled nationally indicate the following energy efficiency for other modes of transportation[23]:

- Passenger Car — 3,558 Btu per passenger-mile
- Intercity Bus — 997 Btu per passenger-mile
- Aircraft — 4,647 - 9,194 Btu per passenger-mile

Using the 1,675 Btu per passenger-mile estimated to be consumed by the electrification alternative with smaller trainsets as a point of reference, it can be seen that, excluding intercity bus, all other modes of transportation are significantly less efficient than rail. In addition, the 1,675 Btu per passenger-mile compares favorably with the 1,975 Btu per passenger-mile estimated for Amtrak operations nationally in 1991.[24]

TABLE 4.6-3 Summary of Energy Consumption of Trains by Alternative

	EXISTING (Base Line)	2010 NO-BUILD (AMD-103)	2010 NO-BUILD (FF-125)		2010 PROPOSED ACTION	
			Small Trains	Large Trains	Small Trains	Large Trains
Total Energy Consumption (Btu/year)	364.7	418.9	1,700	2,924	1,094	1,824
Btu/Passenger-mile	1,997	1,417	3,324	5,717	1,675	2,792
Btu/Seat-mile	834	844	1,634	1,311	885	747
Petroleum Consumption (gal/yr)	2,586,755	2,970,735	12,053,760	20,734,920	3,644,659	6,065,231
Natural Gas Consumption (cubic ft/yr)	0	0	0	0	527,430,221	877,718,961

Note: Energy consumption for the No-Build Alternative - FRA-150 Scenario is not presented in this summary as it was not possible to quantify.

Source: Roy F. Weston, Inc., 1994

4.6.2(c) Energy Savings From Intercity Passenger Diversion

As discussed in section 4.9.1(b), the NEC is a relatively mature travel market with existing high-speed intercity service provided by air carriers. As a consequence, the Proposed Action and related NECIP improvements were assumed to primarily cause a shift in modal choice by intercity travelers. Shifting of travelers from air and automobile to rail has significant energy consumption benefits as shown in Table 4.6-4. In fact, energy consumption benefits would be even greater than shown on Table 4.6-4 because that table assumes the large train configuration for the Proposed Action while the small train configuration is more likely.

4.6.2(d) Alternative Fuel Mix Analysis

Alternative Fuel Mix Assumptions. As described in the DEIS/R, the rationale for the mix of fuels assumed to be used to generate the electricity required for the Proposed Action involves the concept of incremental fuel use, i.e., the fuel that would be used to satisfy an incremental increase in electricity demand.

Since the total electricity demand for the Proposed Action would be a very small fraction of the total electricity demand in the region, it is not anticipated that any electricity generating facilities would be built specifically to satisfy the demands for this project. A major utility operator in the region commented that the incremental fuel analysis developed in the DEIS/R was overly conservative in its reliance on fossil fuels to generate electricity for the Proposed Action. The suggestion was made that the projected regional mix of fuels be used. Such an analysis is presented below for the Proposed Action using the large train assumptions.

TABLE 4.6-4 Total Fossil Fuel Consumption in 2010 for all Modes of Intercity Travel in the NEC

PROJECT ALTERNATIVE	PETROLEUM (MILLION GAL/YR)					NATURAL GAS (BILLION CU FT/YR)
	TRAIN (DIESEL)	AIRCRAFT (JET FUEL)	POWER PLANT (FUEL OIL)	AUTOMOBILE (GASOLINE)	TOTAL PETROLEUM	
No-Build AMD-103	2.97	38.72	0.0	71.89	113.58	0.0
No-Build FF-125	20.73	31.83[1]	0.0	71.07[1]	123.63	0.0
Proposed Action	0.0	26.25	6.07[2]	70.44	102.76	0.88

Notes [1]Because ridership of this alternative is approximately 78 percent of the Proposed Action, diversions from other transport modes are assumed to be proportional.
[2]It is assumed that one-half of the electricity capacity in 2010 would be generated by fuel oil, one-half by natural gas.

Source: Roy F. Weston, Inc., 1994

The overall mix of fuels has been determined for the year 2008, which is the final year in a forecast prepared for the major utility pool servicing the NEC.[25] The breakdown of energy generated by each of the fuel sources is as follows:

- nuclear — 25.2 percent
- hydroelectric — 3.5 percent
- imported hydroelectric — 2.3 percent
- other fuels (bio-fuels, solid waste) — 3.7 percent
- natural gas — 27.0 percent
- oil — 15.5 percent
- coal — 22.9 percent

Note: Does not equal 100 percent due to rounding.

Using this assumed mix of fuels, and the electricity generating requirements for the project, the amounts of coal, oil, and gas consumption are estimated. The transmission loss and generating efficiency assumptions remain the same as in the earlier analysis. The only new data required is a heat content for coal since no incremental coal burning is assumed in the DEIS/R. Using the same source of data as for the heat contents of oil and natural gas,[26] the heat content of coal used by utilities in Connecticut and Massachusetts is found to be 13,148 Btu per pound. Applying this and the other data described, the quantities of oil, gas, and coal consumed are projected. The results of these calculations for the Proposed Action are summarized in Table 4.6-5. Details of the methodology of this evaluation are provided in Volume II, Chapter 6, of this FEIS/R.

TABLE 4.6-5 Alternative Fuel Mix Analysis

PROPOSED ACTION	ALTERNATIVE FUEL	BASE LINE
Annual electricity consumption	166,369,920 kWh	166,369,920 kWh
Annual electricity generation required (w/ 8 percent transmission loss/compensation)	179,679,514 kWh	179,679,514 kWh
Annual energy input required for electricity generation (based on 10,151 Btu/net kWh)	1,824 billion Btu	1,824 billion Btu
Annual oil consumed (based on 15.5 percent of electricity generated using oil; 150,357 Btu/gallon of oil)	1,881,435 gallons	6,065,231 gallons
Annual natural gas consumed (based on 27.0 percent of electricity generated using natural gas; 1,039 Btu/cubic foot of natural gas)	473,090,520 cubic feet	877,718,961 cubic feet
Annual coal consumed (based on 22.9 percent of electricity generated using coal; 13,148 Btu/lb of coal)	31,780,916 pounds (15,890 tons)	0

Source: Roy F. Weston, Inc., 1994

4.6.2(e) Regenerative Braking

Some modern electric high-speed rail systems in Europe incorporate regenerative braking into their design. Amtrak proposes to incorporate this concept into the electrification system between New Haven and Boston. Under this concept, as part of the train's braking system the traction motors are reversed during braking to provide resistance to turning of the drive wheels. Using this resistance, the traction motors serve as small generators that produce electricity which is then fed back into the catenary and used by other trains or through the substation back into the commercial utility grid. This reduces the net amount of electricity required to be generated by utilities.

Calculations by Amtrak based upon the joint Amtrak/FRA demonstrations of the Swedish X-2000 and German ICE trains during 1993 indicate that regenerative braking for intercity trains would reduce the net power drawn from utilities by 17 percent.[27] If commuter rail operations on the NEC are converted to electric operation, even greater savings would be possible because commuter trains brake more often.

The energy calculations for the Proposed Action above do not incorporate the benefits from regenerative braking into the calculations owing to the relative newness of the concept and the need to address certain technical issues prior to widespread operation. Clearly this concept has the potential to significantly improve the attractiveness of electric traction from an energy consumption standpoint.

4.6.2(f) Energy Impacts Associated with Shifts from Freight Rail to Truck

Section 4.9.3(c) discusses concerns that increased intercity and commuter rail operations may create capacity constraints on the NEC that would adversely affect freight rail service. This in turn could lead to the shift by shippers from freight rail service to motor carriers. This shift would have energy consumption implications because of the inefficiency of motor carriers when compared to rail service.

As discussed in Section 4.9.3(c), the potential for such impacts does not result from the Proposed Action per se, but rather from the general increase in intercity traffic that will result from the NECIP program as a whole, from state initiatives to improve commuter rail service on the NEC, and from growth to freight service anticipated by

P&W. As such, the potential for impacts in this area under the No-Build Alternative - FF-125 and FRA-150 scenarios is essentially the same as with the Proposed Action. The additional energy consumed under the different scenarios of diversion described in Section 4.9.3(c) is presented in Table 4.6-6.

TABLE 4.6-6 Potential Additional Energy Consumptions From Trucks

MODE SHIFT	25%		50%	
Annual Freight Rail Growth	2.0%	8.8%	2.0%	8.8%
Additional fuel (diesel) consumed per year (gallons)[1]	8,112,270	24,247,540	16,224,540	48,495,080
Additional energy consumed (billion Btu per year)[2]	1,114	3,420	2,288	6,838

Notes: [1]Based on 5.65 miles/gallon in 1991, as reported in *National Transportation Statistics, Annual Report*, September 1993, Bureau of Transportation Statistics, Department of Transportation.
[2]Based on 141,000 Btu per gallon.

Source: Roy F. Weston, Inc., 1994

The increased energy use by trucks would be partially offset by a decrease in energy use by rail. As freight cars are eliminated by trains, the energy consumption of locomotives would decrease; however, insufficient information is available to estimate the magnitude of this decrease. The estimates presented above should be viewed as a conservative estimate (i.e., it overstates) of the additional energy consumption that would occur from diverting freight from rail to trucks.

As discussed earlier, measures to mitigate impacts on freight service as a result of the Proposed Action are identified in Chapter 5. Simulations conducted for FRA indicate that with these capacity improvements, existing and proposed intercity and commuter schedules can be accommodated without any significant degradation of the freight service presently provided. The impact on energy consumption due to any diversion of freight movements from rail to truck as a result of the preferred alternative would be minimal.

4.6.2(b) Construction Period Impacts

There are no significant energy impacts anticipated during the construction of the Proposed Action. Chapter 5 includes measures that would minimize disruption to other users of the NEC while the project is constructed.

4.7 ARCHAEOLOGY

In each state, the archaeological survey requirements varied, but the goal and actual tasks involved were essentially the same. The goal was to determine whether potentially significant archaeological sites would be adversely impacted by the construction of the Proposed Action. This determination was made in a two-step process. First, the potential of each impact area for containing intact archaeological remains was assessed based on a combination of background research and visual inspection. If an impact area was determined to have moderate to high potential for containing intact remains, systematic subsurface testing was conducted after the DEIS/R was released to locate and identify any possibly significant archaeological sites.

4.7.1 Method of Analysis

Thirty-five potential impact areas associated with the construction of electrification facilities were studied in the initial archaeological assessment (see evaluation criteria in Table 4.7-1). Fourteen of these areas were assessed as having archaeological potential and were therefore subjected to subsurface testing in the form of site locational surveys (Phase I Surveys). No intact or possibly significant cultural remains were located in any impact area in the locational surveys, called Intensive Surveys in Massachusetts.[28] The archaeological survey identified two 19th-century cemeteries, one in Stonington, CT, and the other in North Kingstown, RI. Neither will be directly and immediately impacted by the studied electrification facility sites, but were investigated and recorded to avoid possible accidental or future impact.

TABLE 4.7-1. Evaluation Criteria for Impacts on Archaeological Resources

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Potential for direct disturbance to sites or structures listed on or eligible to the National Register of Historic Places.	Likelihood of intact buried cultural resource sites in areas to be disturbed.	Moderate or high probability of sites or structures being present that meet one of the criteria for National Register significance.

Source: PAST, Inc., 1993

4.7.2 Impacts

4.7.2(a) Environmental Impacts

Each of the substation and utility corridor, switching station and paralleling station, and bridge sites was assessed as having low potential for containing archaeological remains, with the exception of the New London Substation utility feed. The proposed underground feeder would run from the Connecticut Light & Power (CL&P) Williams Street substation via existing streets and the CL&P right-of-way to the proposed substation. Previous archaeological investigations in downtown New London have demonstrated the existence and integrity of significant maritime-related archaeological remains.[29] As a result, the proposed utility corridor is considered to have a moderate potential to contain archaeological remains. One of the two cemeteries, Rhode Island Historical Cemetery #4, in North Kingstown, is eroding severely and is in danger of collapsing onto the ROW. There is a potential for activity associated with construction and/or operations to accelerate the deterioration of the cemetery. Adverse impacts can be avoided through the incorporation of appropriate mitigation measures as outlined in Chapter 5.

4.7.2(b) Construction Period Impacts

Although the potential impact to archaeological resources is considered insignificant at the majority of sites, the New London utility feed could contain buried cultural remains that would be disturbed by construction.

4.8 PUBLIC SAFETY

The Federal Railroad Safety Act of 1970 (recently recodified at 49 U.S.C. 20101, et seq.) assigns jurisdiction over all areas of railroad safety to FRA. FRA is working closely with Amtrak, the states, and other interested parties to ensure that the high-speed rail operations conducted on the Northeast Corridor achieve the same enviable safety record as high-speed rail operations have achieved in Europe and Japan.[30]

This section provides a summary of the evaluation of public safety impacts of the Proposed Action and the No-Build Alternative. It addresses four safety-related issues: (1) the safety of the high-speed rail operation itself; (2) the potential for increased motor vehicle-train collisions; (3) the potential for increased pedestrian-train collisions; and (4) electrical system safety. Evaluation criteria for assessing public safety impacts are shown in Table 4.8-1.

TABLE 4.8-1 Evaluation Criteria for Public Safety Impacts

IMPACT CRITERIA	MEASURE
Safety of train operations.	Change in probability of train accidents and derailments.
Grade crossing safety.	Change in probability of collisions between trains and motor vehicles.
Pedestrian safety.	Change in probability of trains hitting pedestrians.
Electrical system safety.	Probability of electrocutions or fires.

Source: DMJM/Harris, 1993

4.8.1 Impacts

4.8.1(a) Environmental Impacts

Train Operations. There is no evidence suggesting that electrification changes the likelihood of train collisions or derailments at all. Electrification, together with many other actions, is one way to permit higher train speeds to be reached, but the additional risk of collision and derailment is attributable to increased speed, not whether the train is powered by electric motors or some other kind. Therefore, it is highly unlikely that electrification, per se, will change the safety of train operations between New Haven and Boston.

Other changes already made or being planned, such as the purchase of new trainsets capable of higher speed operation, increased train traffic, signal system changes, and a host of other improvements to the ROW, will affect railroad safety, but those actions are beyond the scope of this FEIS/R. FRA is addressing rail safety on this railroad through a regulatory proceeding addressing high-speed trains used on railroads having mixed freight and passenger traffic, a regulatory proceeding of general applicability concerning power brakes, a regulatory proceeding of general applicability concerning track safety standards, and other safety regulatory actions.

In general, high-speed rail operations have proven to be extremely safe. There have been no passenger fatalities on the Japanese *Shinkansen* high-speed trains since they began operation almost 30 years ago. Similarly, there have been no passenger fatalities on the French *TGV* high-speed train in over 10 years of operation.

Vehicular Safety. The probability of a collision between a motor vehicle and a train at each grade crossing was computed using the *Railroad-Highway Grade Crossings Resource Allocation Procedure-Users Guide.*[31] This procedure incorporates the physical and operating characteristics, as well as the accident history at each location, into the accident prediction model. Using this model, a total of 0.208 collisions between Amtrak trains and highway vehicles was predicted in 1992 at the nine public crossings analyzed, or one collision every 5 years under existing conditions. This is a conservative estimate (i.e., one that predicts more collisions than are likely to occur), given that, other than one accident at School Street Crossing in the Spring of 1994, there has been only one reported collision at any of these crossings since 1985.

Table 4.8-2 summarizes the results of the accident prediction model in predicting the number of motor vehicle-train collisions per year and number of years between collisions, respectively, for the Proposed Action and the No-Build Alternative scenarios.

The grade crossing impact analysis predicts that with the Proposed Action, there would be a cumulative probability of 0.307 collisions, or one every 3 years. The model also predicts that with the No-Build Alternative - AMD-103 Scenario, there would be 0.284 collisions, or one every 4 years. The predictions for No-Build Alternative - FF-125 and FRA-150 scenarios would be the same as with the Proposed Action. These should be considered very conservative estimates since the model overpredicts the probability of collisions, based upon actual experience in the NEC.

The predicted increase in total collisions between the existing conditions and the 2010 No-Build Alternative - AMD-103 Scenario conditions is due primarily to increases in vehicular traffic at grade crossings. All other conditions are anticipated to remain unchanged. Electrification of the rail line itself does not contribute to increased probability of collisions; rather, the increased probability results from increased frequency and speeds of trains that result from enhanced service. To the extent that such service would be enhanced in the absence of electrification, the impacts would be equivalent to those that result from the Proposed Action. That is the reason for the similarity between the Proposed Action's impacts and those of the No-Build Alternative - FF-125 and FRA-150 scenarios. The highway safety impact from the Proposed Action and the No-Build Alternative is considered relatively minor.

Nationwide, accidents at grade crossings are one of the most serious safety issues associated with railroading. As a consequence, the Department of Transportation is undertaking a National Highway-Rail Grade Crossing Safety Action Plan comprised of six major initiatives including 55 safety actions.[32] FRA has also undertaken, as part of its high-speed rail program, research, development, and demonstration of innovative grade crossing protection systems. One such system will be jointly demonstrated by FRA, ConnDOT, and Amtrak at the School Street crossing in Groton. This system includes four quadrant gates to limit the ability of motorists to drive around traditional grade crossing protection and a device to warn train engineers if the crossing protection is not working properly or if something is blocking the crossing. Development of these systems offers the prospect of improving the safety of grade crossings.

Another way of improving grade crossing safety is to eliminate the grade crossings. Section 2 of the Amtrak Authorization and Development Act of 1992 (49 U.S.C. 24906) directed the Secretary of Transportation, in consultation with the states along the main line of the NEC, to prepare a plan for the elimination of all highway at-grade crossings of the main line. Section 2 further provided that the plan may provide that the elimination of a crossing not be required if elimination was impracticable or unnecessary.

In response to this direction, FRA has prepared a grade crossing elimination plan as part of the Northeast Corridor Transportation Plan. Public review of the draft elimination plan showed a substantial amount of local opposition to the elimination of certain specific crossings in Connecticut. This opposition was based on concerns over potential restriction of access to coastal resources, possible impacts on wetlands, high cost, disruption caused by relocations and property acquisitions, and visual impact.

In the final plan, FRA recommendations fell into the following three groups:

- GROUP 1 Crossings for which there was a consensus.

- GROUP 2 Crossings for which there was a general consensus, but for which further technical investigation will be needed to confirm the practicality of certain features.

- GROUP 3 Crossings for which there was substantial opposition to the recommendations in the draft plan, and for which development of a final plan should await the results of FRA's efforts in developing and demonstrating enhanced grade crossing protection.

Table 4.8-2 presents how the 16 grade crossings were grouped.

The statute directing FRA to prepare the grade crossing elimination plan did not provide FRA with direction to implement this plan. Throughout NECIP, public grade crossing elimination has been the responsibility of the states. Whether and when the grade crossing plan, or parts of the plan, are implemented will be determined by the states. However, implementation of any part of the plan will reduce the risk of accidents identified above. Implementation of the plan is not part of the proposed electrification project and, as a consequence, the plan is not evaluated in this FEIS/R. If a state chooses to implement all or part of the plan using the Federal-aid highway program funds available for this purpose, then the state would have to undertake a NEPA review of that proposed action at that time.

Pedestrian Safety. The potential for pedestrian-train collisions was evaluated at railroad stations, grade crossings, and illegal crossing points along the NEC, as indicated by worn paths and other evidence of trespasser activity. In general, it can be expected that the probability of pedestrian collisions will increase with increases in frequency and speed of trains because of the reduced time for pedestrians to respond to an approaching train. However, there is no quantitative analytical technique that predicts such increases. Table 4.8-3 lists existing and Amtrak's proposed maximum allowable train speeds by milepost along the NEC.

There are 22 railroad stations in the study corridor. As presented in Section 3.8, pedestrians must cross tracks at 10 of these stations because there are no grade-separated pedestrian ways. The increases in frequency and speed of trains under the Proposed Action and the No-Build Alternative - FF-125 and FRA-150 scenarios could increase the potential pedestrian-train collision risk to the passengers boarding, alighting, and waiting at these stations over what would occur under the No-Build Alternative - AMD-103 Scenario. In addition, seven other stations (Westerly, RI; and South Attleboro, Attleboro, Mansfield, Sharon, Route 128, and Hyde Park, MA) are served by low-level platforms. Although these stations have grade-separated pedestrian crossings, the low-level platforms allow easier access to the tracks, which may place individuals in closer proximity to trains than at stations with high-level platforms. The impact to pedestrians at railroad stations and grade crossings for the Proposed Action and No-Build Alternative scenarios is considered relatively minor.

Illegal pedestrian crossings were identified at 29 locations along the ROW and are listed in Tables 3.8-2 through 3.8-4 in Appendix B of this document. An average of two fatalities per year involving illegal pedestrian crossings have been reported along the NEC. The increases in frequency and speed of trains under the Proposed Action and the No-Build Alternative - FF-125 and FRA-150 scenarios would increase the probability of trains colliding with trespassers over the No-Build Alternative - AMD-103 Scenario.

TABLE 4.8-2 Probability of Rail-Vehicular Collisions at Grade Crossings (in collisions per year)

CROSSING	ANNUAL NUMBER OF COLLISIONS PREDICTED			TRAIN SPEED LIMIT (MPH)		GROUP[4]
	EXISTING[3]	NO-BUILD AMD-103	PROPOSED ACTION, NO-BUILD FF-125 & FRA-150	EXISTING AND NO-BUILD AMD-103	PROPOSED ACTION, NO-BUILD FF-125 & FRA-150	
Chapman's Crossing[1]	N/A	N/A	N/A	70	75	1
Miner Lane	0.024	0.034	0.036	60	80	2
Bank Street	0.017	0.026	0.028	25	35	3
State Street	0.021	0.029	0.031	25	35	3
Gov. Winthrop Blvd.	0.031	0.040	0.043	25	35	3
School Street	0.024	0.032	0.035	70	85	3
Broadway Extension	0.026	0.034	0.037	50	80	1
Latimer Point	0.019	0.027	0.030	70	85	2
Wamphassuc	0.018	0.026	0.028	70	80	2
Cheseborough[1]	N/A	N/A	N/A	70	70	[See Note 5]
Walker's Dock[1]	N/A	N/A	N/A	70	100	3
Freeman's[1]	N/A	N/A	N/A	70	100	3
Palmer Street	0.028	0.036	0.039	80	100	2
Caro's Crossing[1]	N/A	N/A	N/A	80	150	1
Wolf Rocks Road[2]	N/A	N/A	N/A	100	125/140	1
Lazy Lady Farm[1]	N/A	N/A	N/A	95	125/150	1
TOTAL	0.208	0.284	0.307	n/a	n/a	

Notes: [1]This crossing is private. Consequently, no traffic data is available. However, there have been no reported collisions at this location in the past 5 years. This trend is not anticipated to change under either future alternative.

[2]Crossing is programmed for closure.

[3]Conservative estimate.

[4]Group classification in grade crossing elimination plan contained in FRA's Northeast Corridor Transportation Plan.

[5]At the time FRA's grade crossing elimination plan was developed, there was an issue concerning the legality of Amtrak's closing of this crossing. The crossing has since been reopened. ConnDOT and the affected property owners have developed a plan to provide alternative access and close the crossing. This crossing should be considered, therefore, as falling into Group 1.

Source: DMJM/Harris, 1993

TABLE 4.8-3 Maximum Allowable Speed (MAS), 1991 and 2010, New Haven to Boston

MILEPOST LIMITS, 1991 (MP)	MAS 1991 (mph)	MILEPOST LIMITS, 2010 (MP)	MAS 2010 (mph)
Union Station - 72.7	15	Union Station - 73.4	50
72.7 - 73.0	30	73.4 - 73.9	55
73.0 - 73.8	35	73.9 - 80.9	75
73.8 - 74.2	55	80.9 - 81.4	70
74.2 - 77.9	70	(Branford, CT) 81.4 - 81.8	65
77.9 - 78.5	60	81.8 - 85.6	115
78.5 - 80.0	70	85.6 - 85.9	95
(Branford, CT) 80.0 - 80.2	65	85.9 - 87.1	115
80.2 - 81.2	70	87.1 - 87.5	90
81.2 - 81.7	50	(Guilford, CT) 87.5 - 92.9	120
81.7 - 82.0	70	(Madison, CT) 92.9 - 93.4	105
82.0 - 87.2	80	93.4 - 94.4	120
87.2 - 87.4	70	94.4 - 94.9	90
87.4 - 93.0	80	94.9 - 96.1	120
(Madison, CT) 93.0 - 93.3	75	(Clinton, CT) 96.1 - 96.6	110
93.3 - 94.5	80	96.6 - 99.8	120
94.5 - 94.8	70	(Westbrook, CT) 99.8 - 101.8	100
94.8 - 99.6	85	101.8 - 102.2	85
99.6 - 100.1	75	102.2 - 103.6	100
100.1 - 100.3	85	103.6 - 103.9	90
100.3 - 101.0	80	(Old Saybrook, CT) 103.9 - 106.1	100
(Westbrook, CT) 101.0 - 102.1	90	(Conn River, CT) 106.1 - 106.8	75
102.1 - 102.3	65	106.8 - 107.3	95
102.3 - 103.7	90	107.3 - 110.0	100
103.7 - 103.9	75	110.0 - 112.0	90
103.9 - 106.2	90	112.0 - 112.3	75
106.2 - 107.0	45	112.3 - 112.7	80
107.0 - 107.2	70	(Niantic River, CT) 112.7 - 117.1	90
107.2 - 112.2	75	117.1 - 120.7	80
112.2 - 112.8	60	120.7 - 121.4	70

TABLE 4.8-3 Maximum Allowable Speed (MAS), 1991 and 2010, New Haven to Boston (continued)

MILEPOST LIMITS, 1991 (MP)	MAS 1991 (mph)	MILEPOST LIMITS, 2010 (MP)	MAS 2010 (mph)
112.8 - 116.4	75	121.4 - 122.3	80
116.4 - 118.8	60	122.3 - 122.6	55
118.8 - 119.0	55	(New London, CT) 122.6 - 123.1	35
119.0 - 120.8	60	(Thames River, CT) 123.1 - 123.6	50
120.8 - 121.7	50	123.6 - 124.2	65
(New London, CT) 121.7 - 122.0	60	124.2 - 125.3	80
122.0 - 125.0	25	125.3 - 125.7	65
125.0 - 125.2	60	125.7 - 126.2	80
125.2 - 125.7	50	126.2 - 126.6	70
125.7 - 126.2	60	126.6 - 129.3	85
126.2 - 126.5	55	129.3 - 129.8	75
126.5 - 127.0	60	129.8 - 132.1	85
127.0 - 129.4	70	(Mystic River, CT) 132.1 - 132.5	70
129.4 - 129.6	50	132.5 - 133.6	85
129.6 - 130.0	70	133.6 - 134.0	75
130.0 - 130.2	65	134.0 - 134.6	90
130.2 - 131.5	70	134.6 - 135.9	80
131.5 - 132.5	50	135.9 - 136.5	70
(Stonington, CT) 132.5 - 133.6	70	136.5 - 141.8	100
133.6 - 134.0	55	(Westerly, RI) 141.8 - 142.2	90
134.0 - 134.9	70	142.2 - 144.0	110
134.9 - 135.3	60	144.0 - 144.6	100
135.3 - 135.4	70	144.6 - 145.1	110
135.4 - 135.8	60	145.1 - 145.4	90
135.8 - 136.4	50	145.4 - 147.4	110
136.4 - 137.0	70	147.4 - 148.1	100
137.0 - 138.5	80	148.1 - 150.7	110
138.5 - 139.0	75	150.7 - 151.3	100
139.0 - 139.4	80	151.3 - 152.0	110
139.4 - 140.2	75	152.0 - 152.5	95
140.2 - 141.0	80	152.5 - 154.0	110

TABLE 4.8-3 Maximum Allowable Speed (MAS), 1991 and 2010, New Haven to Boston (continued)

MILEPOST LIMITS, 1991 (MP)	MAS 1991 (mph)	MILEPOST LIMITS, 2010 (MP)	MAS 2010 (mph)
(Westerly, RI) 141.0 - 141.4	75	154.0 - 154.5	100
141.4 - 141.7	80	(Kingston, RI) 154.5 - 159.8	150
141.7 - 142.2	75	159.8 - 160.7	140
142.2 - 144.2	80	160.7 - 170.5	150
144.2 - 144.5	75	170.5 - 171.6	120
144.5 - 145.1	80	171.6 - 172.8	115
145.1 - 145.4	70	172.8 - 180.0	125
145.4 - 147.5	85	180.0 - 181.8	105
147.5 - 148.2	75	181.8 - 182.2	65
148.2 - 150.9	85	182.2 - 184.9	80
(Richmond, RI) 150.9 - 151.1	80	(Providence, RI) 184.9 - 185.6	35
151.1 - 152.0	85	185.6 - 186.0	90
152.0 - 152.7	75	186.0 - 186.4	65
152.7 - 158.4	80	186.4 - 187.4	100
158.4 - 163.0	100	187.4 - 187.9	85
163.0 - 168.0	110	187.9 - 189.5	100
168.0 - 168.3	100	(Pawtucket, RI) 189.5 - 190.6	70
168.3 - 171.7	95	(South Attleboro, MA) 190.6 - 193.9	150
171.7 - 175.0	85	(Attleboro, MA) 193.9 - 194.7	110
175.0 - 178.0	110	(Mansfield, MA) 194.7 - 205.0	150
178.0 - 181.0	90	205.0 - 206.7	140
(Providence, RI) 181.0 - 181.9	50	206.7 - 207.1	135
181.9 - 182.0	45	(Sharon, MA) 207.1 - 216.1	140
182.0 - 184.4	50	(Route 128, MA) 216.1 - 220.4	150
184.4 - 184.5	45	220.4 - 221.0	135
184.5 - 185.0	50	(Forest Hills) 221.0 - 224.7	140
185.0 - 185.5	20	224.7 - 225.2	135
185.5 - 186.0	70	225.2 - 225.7	125
186.0 - 186.4	45	225.7 - 227.0	140
186.4 - 188.7	70	(Back Bay) 227.0 - 229.0	45
188.7 - 190.5	50	(South Station) 229.0 - 229.3	15

TABLE 4.8-3 Maximum Allowable Speed (MAS), 1991 and 2010, New Haven to Boston (continued)

MILEPOST LIMITS, 1991 (MP)	MAS 1991 (mph)	MILEPOST LIMITS, 2010 (MP)	MAS 2010 (mph)
190.5 - 193.8	95		
(Attleboro, MA) 193.8 - 194.4	90		
194.4 - 195.0	95		
195.0 - 205.0	100		
205.0 - 213.8	80		
213.8 - 214.1	80		
214.1 - 217.4	95		
217.4 - 217.5	60		
217.5 - 226.9	100		
226.9 - 228.3	30		
228.3 - South Station	15		

Notes: [1] Actual speeds at any precise point may be substantially lower because of the need to decelerate or accelerate train speed to comply with adjacent MAS block limits, the need to make station stops, the need to comply with signals, and the need to comply with special restrictions at such locations as moveable bridges, highway grade crossings or difficult curves.
[2] All milepost limits are approximate.

Sources: Amtrak, Track Chart, 1991
Amtrak, Shore Line Proposed High Speed Configuration, 1992

System Safety. The bonding and grounding of the Proposed Action electrification system is designed to ensure that all potential voltages under all conditions would be controlled and kept within safety levels as defined by the applicable standards. All potentially live components would be designed such that the vertical and horizontal distances specified in the National Electric Safety Code (NESC) would be adhered to. Where necessary, additional barriers would be installed to ensure strict compliance. All structures are designed so as not to be easily climbed. At overhead bridges, a barrier would be installed to prevent contact with the feeder wires. All electrical wayside facilities would be enclosed by appropriate fencing. Wire heights at grade crossings would be installed at a minimum height of 22 feet to provide adequate clearance to vehicular traffic and to comply with requirements of the NESC and the American Railway Engineering Association (AREA). All electrical facilities would be clearly marked. Employees would be trained in proper work techniques; this training is currently in place for all Amtrak employees working between New Haven and Washington.

The electrification system would be designed to withstand the mechanical forces that it would be subject to, including hurricane winds, icing conditions, and cold weather. The system would be designed with a safety factor of at least 200 percent (300 percent for critical components).

Fire Safety. Although operational fires associated with electric operations have been documented by Metro North in the electrified portion of the NEC south of New Haven, the impact on passengers, crew, firemen, and other

workers has been minimal, due to built-in safety factors. It is anticipated that there would be no significant impacts from operational fires under the Proposed Action.

A different fire safety issue is associated with the No-Build Alternative - FF-125 and FRA-150 scenarios. Each would carry hundreds of gallons of combustible fuel on-board, creating the potential for serious fires in the New York City tunnels and under Pennsylvania Station in New York City even though the locomotives are operating on third rail electric power in this area. Since the DEIS/R was published, there have been two fires in Pennsylvania Station involving RTL gas turbine trainsets. Fighting fires in a confined underground space is difficult and presents risks for firefighters and passengers as well as to the structural integrity of Penn Station. Elimination of non-electric locomotives from this area has been advocated by the New York City Fire Marshal. Fire safety would be a component of the designs for the No-Build Alternative - FF-125 and FRA-150 scenarios. However, the fact that combustible fuels would be present under these scenarios creates a risk that would not be present with the Proposed Action.

Summary. For the No-Build Alternative - FF-125 and FRA-150 scenarios, similar safety regulations and procedures would be developed and enforced. There would be no significant difference between the safety associated with the Proposed Action and that of the No-Build Alternative. The system and operations of all alternatives are expected to be safe, and no impacts are considered in the area of system safety.

4.8.1(b) Construction Period Impacts

For the Proposed Action, it is expected that while construction is underway, the track sections under construction would be taken out of service and operations in other tracks would continue. The safety of such adjacent operations are of concern, and the proper training of the workers would be undertaken to ensure their safety. Construction guards and signage should safeguard the general public. The impacts to safety during construction of the Proposed Action are considered relatively minor.

There is no construction activity for the No-Build Alternative scenarios. Thus, there would be no construction safety impacts for those alternatives.

4.9 TRANSPORTATION, TRAFFIC, AND CIRCULATION

This section documents proposed changes in service and projected ridership associated with the Proposed Action and the No-Build Alternative scenarios, and summarizes the potential benefits and impacts on transportation, traffic, and circulation patterns. The evaluation criteria employed to assess the impacts of the Proposed Action and the No-Build Alternative scenarios on the transportation system within the NEC are shown in Table 4.9-1.

4.9.1 Projected 2010 Intercity Service and Ridership

4.9.1(a) Proposed Service

Proposed Action: The completion of NECIP between Boston and New York City, including the electrification project that is the subject of this FEIS/R, will result in significantly improved service in the form of reduced travel times. Travel times are to be reduced from 4 hours to less than 3 hours for express trains, and from 5 hours to approximately 3 hours, 45 minutes for conventional trains (see Table 4.9-2). This improved service is expected to increase the demand for rail passenger service, and Amtrak will increase the frequency of trains to accommodate the demand. Service is to increase from 10 trains at present to 26 trains in each direction per weekday, with 16 express trains within a total of 26. Table 4.9-3 list the projected 2010 schedule between Boston and New Haven.

No-Build Alternative - AMD-103 Scenario: This No-Build Alternative Scenario is the present service increased slightly to accommodate projected 2010 demand in the absence of electrification. Service will increase from 10 trains to 12 trains in each direction per typical weekday.

No-Build Alternative - FF-125 Scenario: This scenario would operate at the same frequency as the Proposed Action, but would operate under a 3-hour, 16-minute Boston to New York schedule, approximately 20 minutes slower than trains in the Proposed Action. Express and conventional train consists would be similar to the Proposed Action.

No-Build Alternative - FRA-150 Scenario: This non-electric scenario would have the same trip time and operating characteristics as the Proposed Action. Express and conventional train consists would also be similar.

TABLE 4.9-1 Evaluation Criteria for Transportation, Traffic, and Circulation Impacts

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Effect of increase in train speed and frequency on vehicle delay at grade crossings.	Comparison of project- generated delay at crossings with existing delay.	None
Effect of project-generated traffic at train stations on existing traffic patterns.	Comparison of project- generated traffic with existing flows.	Decline in peak hour LOS, below LOS D, at key intersections.
Effect of project-generated intercity train ridership on aircraft and automobile traffic.	Project-generated reduction in aircraft use.	None.
	Project-generated reduction in vehicle miles of travel.	None.
Effect of bridge modifications on traffic flow pattern.	Temporary change in traffic flow pattern and/or vehicle delay.	Decline in peak hour LOS, below LOS C in rural areas and LOS D in urban areas, at key intersections along alternate routes.
Effect on other NEC railroad operations (commuter, freight)	Adverse operating or economic effects	None
Effect of change in project- generated traffic on parking capacity at train stations.	Change in parking demand at each train station.	None

Source: DMJM/Harris, 1994

TABLE 4.9-2 Existing and Projected Travel Times: Boston and New York City

STATION	CONVENTIONAL SERVICE		EXPRESS SERVICE	
	TRAVEL TIMES (minutes)		TRAVEL TIMES (minutes)	
	1994[1]	2010	1994[2]	2010
South Station	0	0	0	0
Back Bay	6	5	5	5
Route 128	19	14	17	13
Providence	49	36	44	33
Kingston	74	55	-	-
Westerly	91	70	-	-
Mystic	102	80	-	-
New London	116	95	-	-
Old Saybrook	136	115	-	-
New Haven	179	145	150	114
NYC Penn Station	294	210[3]	250	179

Notes: [1]Train No. 169 (Mayflower)
[2]Train No. 153 (New England Express)
[3]While TPC data shows a 210 minutes (3 hours and 30 minutes) Boston-NYC trip time, the Amtrak schedule would be a 3 hour, and 45 minute trip time to include 15 minutes of scheduled "pad."

Sources: Amtrak, Train Performance Calculator data dated April 15, 1992
Amtrak, *Northeast Timetable - Spring/Summer 1994*, effective May 1, 1994
Amtrak, Schedule Sheets for 2010 Operations, September 22, 1994

4.9.1(b) Travel in the NEC

Total travel in the NEC was projected for the year 2010 using a multimodal choice model. This model first projected total corridor travel using 2010 estimates of population, employment, and per capita personal income in each metropolitan area (New York, New Haven, Providence, and Boston). Next, the model estimated automobile, air, and train ridership through a two-step mode choice model which considered travel factors such as: travel time, travel cost, frequency of service, ground access/egress time and cost, and passenger processing time. The travel factors were derived from research conducted into the travel behavior in the Washington to New York City segment of the NEC and from a recent high-speed rail study.

TABLE 4.9-3 Proposed 2010 Boston-New York Amtrak Service on the NEC[1]

26 WEEKDAY WESTBOUND TRAINS												
TYPE	BOS	BBY	RTE	PVD	KIN	WLY	MYS	NLC	OSB	NHV	STM	NYP
Express	4:25a	4:30	4:38	4:58				5:38	5:56	6:20	6:53	7:24
Express	5:40	5:45	5:53	6:13				6:53		7:37		8:42
Mail	5:45	5:50	6:05	6:40	7:00	7:12	7:23	7:34	7:52	8:35	9:08	9:53
Express	6:40	6:45	6:53	7:13						8:34		9:39
Conv.	6:55	7:00	7:15	7:37	8:00			8:28		9:08	9:33	10:25
Express	7:40	7:45	7:53	8:13							10:04	10:39
Conv.	7:55	8:00	8:15	9:00				9:28	9:46	10:11	10:36	11:25
Express	8:40	8:45	8:53	9:13						10:34		11:39
Express	9:40	9:45	9:53	10:13							11:04	1239
Conv.	9:55	10:00	10:15	10:37	11:00	11:20	11:31	11:49		12:14	12:39	1:25
Express	10:40	10:45	10:53	11:13						12:34		1:39
Express	11:40	11:45	11:53	12:13							2:04	2:39
Conv.	11:55	12:00	12:15	1:00				1:28		2:10	2:35	3.25
Express	12:40	12:45	12:53	1:13						2:34		3:39
Express	1:40	1:45	1:53	2:13							4:04	4:39
Conv.	1:55	2:00	2:15	2:37				3:25		4:08	4:33	5:25
Express	2:40	2:45	2:53	3:13						4:34		5:39
Express	3:40	3:45	3:53	4:13						5:34	6:06	6:43
Conv.	3:55	4:00	4:15	4:37	5:00		5:20	5:31	5:49	6:14	6:39	7:25
Express	4:40	4;45	4:53	5:13				5:53		6:37	7:09	7:46
Express	5:40	5:45	5:53	6:13						7:34		8:39
Conv.	5:55	6:00	6:15	6:37		7:09		7:28		8:10	8:43	9:25
Express	6:40	6:45	6:53	7:13							9:04	9:39
Express	7:40	7:45	7:53	8:13						9:34	10:06	10:43
Conv.	7:55	8:00	8:15	8:37	9:00			9:28	9:46	10:11	10:44	11:30
Conv.	10:30	10:40	10:55	11:20	11:45	11:59	12:10	12:13	12:33	1:15	1:55	2:30

TABLE 4.9-3 Proposed 2010 Boston-New York Amtrak Service on the NEC (continued)

26 WEEKDAY EASTBOUND TRAINS												
TYPE	**NYP**	**STM**	**NHV**	**OSB**	**NLC**	**MYS**	**WLY**	**KIN**	**PVD**	**RTE**	**BBY**	**BOS**
Express	6:00a		7:13		7:57				8:37	8:57	9:05	9:10
Conv.	6:15	6:52	7:33	7:57	8:14		8:34		9:06	9:28	9:38	9:43
Express	7:00	7:30	8:13						9:33	9:53	10:01	10:06
Express	8:00	8:30							10:26	10:46	10:54	10:59
Conv.	8:15	8:47	9:26	9:49	10:16	10:27	10:39	10:50	11:11	11:31	11:40	11:45
Express	9:00	9:30	10:10						11:23	11:43	11:56	12:01
Express	10:00		11:05						12:26	12:46	12:54	12:59
Conv.	10:15	10:52	11:26		12:08			12:48	1:08	1:28	1:38	1:42
Express	11:00	11:30							1:26	146	154	159
Express	12:00		1:05						2:26	2:46	2:54	2:59
Conv.	12:15	12:52	1:26	1:50	2:07		2:30		3:10	3:30	3:40	3:45
Express	1:00	1:30							3:26	3:46	3:54	3:59
Express	2:00		3:05						4:26	4:46	4:54	4:59
Conv.	2:15	2:48	3:25	3:52	4:09	4:20		4:43	5:03	5:25	5:40	5:45
Express	3:00	3:30			4:50				5:30	5:50	5:58	6:03
Express	4:00		5:05						6:26	6:46	6:54	6:59
Conv.	4:15	4:52	5:33	5:57	6:14			6:44	7:10	7:30	7:40	7:45
Express	5:00	5:30	6:07						7:28	7:48	7:56	8:01
Conv.	5:20		6:30						8:05	8:25	8:35	8:40
Express	6:00		7:05		7:45				8:28	8:48	8:56	9:01
Conv.	6:15	6:52	7:26	8:00	8:17	8:28	8:39	8:50	9:10	9:30	9:40	9:45
Express	7:00	7:32	8:07						9:28	9:48	9:56	10:01
Express	8:00		8:05						10:26	10:46	10:54	10:59
Conv.	8:15	8:52	9:25	10:03	10:20			10:50	11:10	11:30	11:40	11:45
Express	9:00	9:30	9:07						11:28	11:48	11:56	12:01
Conv.	3:40a	4:25	5:30	6:10	6:27	6:38	6:49	6:50	7:20	7:40	7:55	8:00

Notes: [1]Times at intermediate stops subject to change as electrification design progresses.
Key: BOS-Boston South Station; BBY-Back Bay Station; RTE-Route 128 Station; PVD-Providence; KIN-Kingston; WLY-Westerly; MYS-Mystic; NLC-New London; OSB-Old Saybrook; NHV-New Haven; STM-Stamford; NYP-NYC Penn Sta.
Source: Amtrak, 1994

Proposed Action. In 2010, approximately 21.6 million people will travel in the NEC with origins and destinations between New York City and Boston (see summary table). This represents an almost 20 percent increase in total travel over the 1993 level. The vast majority of these people, 72.3 percent, will continue to travel by automobile. Almost 17 percent of these people will travel by Amtrak intercity rail service, given implementation of the Proposed Action and other NECIP improvements. The remaining 10.9 percent of the people traveling in this portion of the NEC will travel by air.

ANNUAL INTERCITY TRIPS
(Million trips per year)

MODE	EXISTING (1993)		NO-BUILD (2010) AMD-103		NO-BUILD (2010) FF-125		NO-BUILD (2010) FRA-150		PROPOSED ACTION (2010)	
	TRIPS	%	TRIPS	%	TRIPS	%	TRIPS	%	TRIPS	%
Auto	13.42	74.5	15.92	73.8	15.74	73.0	15.63	72.5	15.60	72.3
Air	3.53	19.6	3.78	17.5	2.99	13.8	2.48	11.5	2.35	10.9
Rail	1.05	5.9	1.87	8.7	2.84	13.2	3.46	16.0	3.63	16.8
TOTAL	18.00	100.0	21.57	100.0	21.57	100.0	21.57	100.0	21.57	100.0

Note: Does not equal 100 percent due to rounding.

Primarily because high-speed service already exists within the NEC, via plane, implementation of the Proposed Action is not assumed in this analysis to have an effect on total intercity travel in the NEC. Instead, the project is expected to create significant shifts in the choices made by travelers regarding their mode of travel in the NEC. Total travel will remain the same for the Proposed Action and the No-Build Alternative scenarios, although the percentage carried by each transportation mode (mode split) varies dramatically. With implementation of the Proposed Action, the mode split for intercity rail is projected to increase to 16.8 percent, almost a doubling of rail ridership versus from the No-Build Alternative - AMD-103 Scenario, while the air mode split will diminish from 17.5 percent to 10.9 percent, a decline of 38 percent.

Several factors are responsible for this shift in mode choice. A portion is due to the attractiveness of intercity rail relative to other modes as these modes become more congested. This is evidenced by the projected increased rail ridership in the No-Build Alternative - AMD-103 Scenario from existing ridership. Rail ridership is projected to increase 78 percent while ridership in the automobile and air modes is projected to increase by 19 percent and 7 percent, respectively. However, the primary factors are the proposed significant improvements in Amtrak's travel time and service expected to result from NECIP improvements including electrification. First, by reducing the express travel time from Boston or Providence to New York City, intercity rail becomes substantially more competitive with the air market. Second, although flight time between the major airports of these cities is approximately 1 hour, many of these airports are located outside the city centers and access to and from the airports is inconvenient and unpredictable. Intercity rail delivers passengers to the urban centers of Boston, Providence, and New York City, and other cities that will be served by the express and/or improved conventional service.

Like the mode split for air, the mode split for automobile travel will also drop slightly. However, the increase in rail ridership will come primarily from air travelers. Implementation of the Proposed Action would have a limited effect on automobile traffic because the factors that make automobile travel more attractive than rail in certain circumstances will remain in place. These factors include the convenience of individualized travel scheduling and direct origin and destination travel, as well the lower cost per passenger for more than one passenger, relative to air and intercity rail service.

No-Build Alternative Scenarios. Also using a multimodal choice model, total ridership was projected for the No-Build Alternative - FF-125 and FRA-150 scenarios. Total 2010 ridership for the No-Build Alternative - FF-125 and FRA-150 scenarios would equal 2.84 million trips and 3.46 million trips, respectively. In each case, total ridership drops from that of the Proposed Action; FF-125 ridership is about 22 percent lower and FRA-150 ridership is 4.7 percent lower. The substantial drop in ridership with the No-Build Alternative - FF-125 Scenario, versus that of the Proposed Action results from the longer FF-125 travel time between Boston and New York City.

4.9.2 Benefits

4.9.2(a) Transportation

The 1991 Intermodal Surface Transportation Efficiency Act established the goal of improving the intermodal nature of the transportation system in the United States as a fundamental tenet of national transportation policy. The Proposed Action would support this goal by reinvigorating intercity passenger rail transportation in the NEC, and better integrating the intercity rail system into the metropolitan transportation networks of the major urban areas in this corridor.

4.9.2(b) System Efficiency

The Proposed Action would improve NEC rail passenger service through reduced travel times and increased reliability. Travel time between New York and Boston would decline in excess of 25 percent from travel times under the No-Build Alternative - AMD-103 Scenario. In addition, electric-powered train operating characteristics pertaining to maximum speed, acceleration and deceleration rates, reliability, and cost of maintenance represent significant improvements when compared to the diesel-electric trains currently serving the New Haven to Boston route.

Similar, but somewhat less benefit, is projected for the No-Build Alternative - FF 125 Scenario. Benefits from the No-Build Alternative FRA-150 Scenario would closely approximate those of the Proposed Action.

The Proposed Action would also benefit the Massachusetts Bay Transportation Authority (MBTA) in the long term by facilitating the electrification of the commuter rail system in the Boston region.

4.9.2(c) Ridership

The Proposed Action is projected to stimulate annual ridership of approximately 3.63 million intercity rail passengers in this portion of the NEC, almost two times that of the No-Build Alternative - AMD-103 Scenario. FF-125 and FRA-150 riderships are about 22 percent and 4.7 lower, respectively, than that of the Proposed Action.

4.9.2(d) Air Traffic and Related Ground Transportation

The Proposed Action would have a positive effect on air traffic at the major airports in the corridor. The limited capacity of the airports in Boston and New York City could be used for longer distance trips where rail is not time-competitive and which offer greater economic opportunities for air carriers. Also, by lessening the need to use limited airport capacity for New York City to Boston service, the demand for additional airport capacity (and the environmental impacts associated with providing that capacity) in the two cities would be lessened. As a point of reference, presently 14 percent of the flights that originate from Logan Airport are destined for one of the New York City airports.

Between Boston and New York City, the projected decrease in air passengers that should result from the Proposed Action (1.2 million passengers annually; 600,000 in each direction) could result in some improvement in vehicular traffic flow at Logan Airport. Of all Logan passengers, 64.8 percent make their trips to and from the airport by some type of automobile (personal, taxi, or limousine).[33] Assuming the same percentage for the proposed 600,000 Boston to New York passengers expected to shift to intercity trains, 389,000 vehicle-trips per year to Logan Airport would be saved due to the Proposed Action. A similar benefit would likely be experienced between Providence's T.F. Green Airport and New York City, where 250,000 air passengers are anticipated to

shift to intercity trains. Because the airports in New York handle much larger volumes of traffic and passengers, the effect at these three airports is not expected to be as beneficial as at Logan Airport.

With projected ridership only approximately 5 percent lower than that of the Proposed Action, ground transportation benefits would also be derived from the No-Build Alternative - FRA-150 Scenario. Similarly, some benefits would also be derived from the No-Build Alternative - FF-125 Scenario, but not to the extent of those associated with the Proposed Action or the No-Build Alternative - FRA-150 Scenario.

4.9.3 Impacts

4.9.3(a) Transportation Impacts

Traffic at Amtrak Express Stations. Table 4.9-4 shows station-by-station ridership for the Proposed Action at the express stations between Boston and New Haven. Existing ridership is reflected in Table 3.9-2. Also shown in this table is the projected commuter rail ridership at each of these stations. With the exception of Route 128 Station, 2010 commuter rail ridership vastly overshadows that of intercity rail service. At Route 128 Station, average daily ridership for commuter rail and intercity rail services are roughly equal in 2010. A larger disparity exists for total annual ridership because commuter rail service operates primarily on weekdays, while Amtrak provides service 7 days a week. Intercity rail ridership is not listed for the New Haven station because the Proposed Action would occur primarily north of this station.

TABLE 4.9-4 Projected 2010 Amtrak and Commuter Ridership at Express Stations (on & off)

STATION	INTERCITY PASSENGERS	COMMUTERS	TOTAL
South Station, Boston	1,400,055	9,650,000	11,050,055
Back Bay, Boston	450,361	4,900,000	5,350,361
Route 128, MA	933,261	650,000	1,583,261
Providence, RI	843,254	240,000	1,083,254
New Haven, CT	338,789	2,265,576[1]	2,265,576

Notes: [1]Does not include additional ridership resulting from implementation of the proposed Capitol Line between New Haven and Hartford.

Source: Charles River Associates, CTPS, ConnDot, 1993, 1994

Project-generated traffic at key intersections near the Amtrak express stations would not cause changes in level of service from the 2010 future no-build levels of service, with the exception of Providence Station (see Table 4.9-5), which would change from LOS C to LOS D. LOS D is considered acceptable in an urban area. Since impacts in these areas do not exceed the evaluation thresholds, they are not discussed further. Chapter 5 discusses additional analyses to be completed for the Route 128 Station as part of a separate environmental process.

TABLE 4.9-5 Express Station Intersection Analysis

A: Unsignalized Intersections (AM Peak)

Intersection/Approach	Location	1993 Existing		LOS	2010 No-Build AMD-103		LOS	Proposed Action		LOS
		RC	Demand		RC	Demand		RC	Demand	
Blue Hill Dr/Rt 128	Dedham, MA									
LT From 128 Ramp		198	457	D	-175	669	F	-264	730	F
LT From Blue Hill Dr		1016	35	A	876	51	A	846	51	A
Blue Hill Dr/Univ Av	Dedham, MA									
LT From Univ Av		491	184	A	See Table C			See Table C		
All Moves From Blue Hill		-199	550	F						
Smith/Gaspee/State	Providence, RI									
LT from WB Smith		472	319	A	See Table C			See Table C		
All from Gaspee		-278	500	F						
All from State		34	52	E						

B: Unsignalized Intersections (PM Peak)

Intersection/Approach	Location	1993 Existing		LOS	2010 No-Build AMD-103		LOS	Proposed Action		LOS
		RC	Demand		RC	Demand		RC	Demand	
Blue Hill Dr/Rt 128	Dedham, MA									
LT From 128 Ramp		327	89	B	-45	165	F	-124	179	F
LT From Blue Hill Dr		447	52	A	89	96	E	39	97	E
Blue Hill Dr/Univ Av	Dedham, MA									
LT From Univ Av		167	717	D	See Table D			See Table D		
All Moves From Blue Hill		-133	201	F						
Smith/Gaspee/State	Providence, RI									
LT from WB Smith		181	386	D	See Table D			See Table D		
All from Gaspee		-390	410	F						
All from State		-179	197	F						

RC = Available Reserve Capacity   LOS = Level of Service

TABLE 4.9-5 Express Station Intersection Analysis (continued)

C: Signalized Intersections (AM Peak)

Intersection/Approach	Location	1993 Existing		LOS	2010 No-Build AMD-103		LOS	Proposed Action		LOS
		V/C	Delay		V/C	Delay		V/C	Delay	
Summer/Atlantic Overall	Boston, MA	1.03	105	F	0.76	19	C	0.76	19	C
Blue Hill/Univ Av Overall	Dedham, MA	See Table A			0.55	11	B	0.59	12	B
Smith/Gaspee/State Overall	Providence, RI	See Table A			0.90	24	C	0.93	27	D
Francis/Gaspee Overall	Providence, RI	0.42	5	A	0.88	17	C	0.95	21	C

D: Signalized Intersections (PM Peak)

Intersection/Approach	Location	1993 Existing		LOS	2010 No-Build AMD-103		LOS	Proposed Action		LOS
		V/C	Delay		V/C	Delay		V/C	Delay	
Summer/Atlantic Overall	Boston, MA	1.28	154	F	1.11	67	F	1.16	71	F
Blue Hill/Univ Av Overall	Dedham, MA	See Table B			0.69	12	B	0.78	12	B
Smith/Gaspee/State Overall	Providence, RI	See Table B			0.70	19	C	0.72	20	C
Francis/Gaspee Overall	Providence, RI	0.56	9	B	0.90	22	C	0.94	31	D

LOS = Level of Service V/C = Volume to Capacity Ratio Delay = Average Delay Per Vehicle in seconds

Source: DMJM\Harris, 1993

With only slightly less ridership, the No-Build Alternative - FRA-150 Scenario is projected to generate approximately the same level of traffic impacts as those of the Proposed Action. Traffic impacts for the No-Build Alternative - FF-125 Scenario would be even less. As in the Proposed Action, the impacts of traffic volumes in all of the No-Build Alternative scenarios do not exceed evaluation thresholds and will not be considered further.

Parking at Amtrak Express Stations. Parking demand at Amtrak stations is expected to increase, primarily due to increased ridership on the faster Amtrak express passenger rail service in the NEC rather than from the electrification project itself. Table 4.9-6 presents the existing parking supply and demand, along with the projected demands for the Proposed Action and No-Build Alternative at Amtrak express stations in the corridor. Additional parking demand stimulated by commuter rail service is not included in this table.

TABLE 4.9-6 Amtrak-Generated Parking Demand at Railroad Stations[1]

STATION	SUPPLY	DEMAND			
	1993 EXISTING	1993	2010 NO-BUILD AMD-103	2010 NO-BUILD FF-125	2010 NO-BUILD FRA-150 & PROPOSED ACTION
South Station	0	110	145	178	225
Back Bay	0	15	35	55	70
Route 128	820[2]	170	550	970	1,230
Providence	360[3]	200	415	525	665
New Haven	1,207[4]	240	425	456	470

Sources: [1]Demand: Estimates by DMJM/Harris
[2]MBTA
[3]RIDOT
[4]ConnDOT-125 spaces reserved for Police Department

South Station/Back Bay: In 2010, 8 percent of the Amtrak passengers accessing South Station and Back Bay Station in Boston would use long-term parking, according to the mode split analysis completed for the DEIS/R (see Table 9-10 in Chapter 9 of Volume III of the DEIS/R). To accommodate this demand, 225 parking spaces would be required.

At South Station and Back Bay in Boston, no parking dedicated for intercity rail passengers exists today. A limited parking supply (about 225 spaces), presently under construction as part of the South Station Transportation Center, would accommodate short-term parking for purposes like purchasing Amtrak tickets and obtaining travel information, and longer-term parking for intercity rail passengers. Pricing strategies will be developed to ensure that this parking will not be cost-effective for use by employees commuting to work near the station.

No parking dedicated for Amtrak service is planned for Back Bay Station. Since 1978, a "parking freeze" has been implemented in the City of Boston as part of the Federally enforceable State Implementation Plan aimed at achieving acceptable air quality standards under the Federal Clean Air Act. This freeze limits the supply of commercial parking in the downtown area of Boston, as a means of protecting operations of existing roadway

infrastructure from excessive congestion and stimulating transit use for employment access in Boston. A bank of parking spaces has been created as part of the parking freeze; spaces for long-term Amtrak parking have to compete with spaces allocated to other types of development within Boston.

Fortunately, Back Bay and South Station have very good transit access. Back Bay Station has the MBTA Orange Line subway, commuter rail services, and local and regional bus service. South Station has the MBTA Red Line subway, commuter rail services, and local, regional, and long-distance bus services. South Station will also have quick access to/from Logan Airport following the opening of the Third Harbor Tunnel.

Route 128 Station: Forecasts prepared for the MBTA by the Central Transportation Planning Staff (CTPS) indicate that demand for parking by Amtrak passengers would reach 1,230 spaces by 2010.[34] In addition, 1,640 spaces are projected as necessary to accommodate demand for MBTA commuter rail parking.

Amtrak has committed to working with the Executive Office of Transportation and Construction (EOTC) and the MBTA to provide the additional parking at the Route 128 Station needed to satisfy intercity and commuter passenger demand and to achieve agency clean air goals. The MBTA and Amtrak are cooperating in an evaluation of alternatives to meet the future parking demand at Route 128 Station. The MBTA will be responsible for developing this additional parking and will be responsible for any required environmental documentation.

Providence: Table 4.9-6 indicates that demand for intercity rail passenger parking at Providence Station would reach 665 spaces by 2010. This far exceeds the existing supply of 360 spaces.

While there are no plans to provide additional parking at the station, the Rhode Island Department of Transportation (RIDOT) has indicated that two potential projects to expand parking have already been identified. A private developer owning air rights over the rail tracks in the area of the station has proposed to construct a parking garage which could also accommodate Amtrak parking demand. In addition, RIDOT is presently analyzing possible development of a large (5,000 parking spaces) garage adjacent to the Providence Station as part of a larger plan for the economic development, transportation improvement, and revitalization of downtown Providence. This garage would provide the additional spaces required for Amtrak's intercity operations as well as the commuter service. RIDOT and the Federal Highway Administration have initiated an environmental assessment of this proposal.[35]

New Haven-Union Station: Amtrak parking demand in 2010 at the New Haven station is projected to equal 470 spaces. However, total demand for Amtrak and commuter rail passenger parking in 2010 would exceed the 1,207 spaces in the existing parking garage.

Because of commuter rail demand for parking, in particular, the Connecticut Department of Transportation (ConnDOT) is presently exploring options for expanding parking in the area of the existing garage. While Amtrak parking is not reserved separately from that for commuter rail, the established price structure favors longer term parking. According to the ConnDOT Office of Rail Operations, floors can be added to the existing garage to accommodate additional parking and/or a garage could be constructed on the site of two at-grade parking lots adjacent to the existing facility. Finally, a 500-space parking garage nearby the station just came on the market. This facility may be acquired by ConnDOT for expansion of the parking supply at New Haven Station.

Pedestrian Traffic at South Station and Back Bay.

Pedestrian Volumes and Activity: In a number of comments received on the DEIS/R, concerns about pedestrian access to the urban stations of South Station and Back Bay Station in Boston were voiced. This analysis addresses these concerns. Intercity train service generates relatively little pedestrian traffic in the vicinity of South Station and Back Bay Station, aside from passenger loading/unloading at the curbside immediately adjacent to each of the two station buildings. In general, tourists arriving and departing on intercity trains are unlikely to walk distances of any great length with their baggage and children. Business passengers with destinations relatively close to South Station and Back Bay Station may choose to walk to/from the train station, especially during

normal business hours. Taxis, buses, and the subway also provide options for station access for all passengers and for business passengers, especially outside of normal business hours.

This access pattern is reflected in the percentage of passengers accessing South Station and Back Bay Station by mode of transportation (mode split). The mode split for South Station is 70 percent walking/transit, 28 percent by passenger car drop-off/taxi, and 2 percent parking vehicles.[36] Given the similarity in intermodal transportation options provided at the two stations (commuter rail, subway, local and regional bus service, drop-off, taxi, walking, etc.), the same mode split has been assumed for Back Bay Station. Therefore, based on the overall 2010 ridership projections for Amtrak service in the NEC, just over 3,500 Amtrak passengers either walk or take transit to/from South Station and Back Bay Station on an average day.

Peak travel periods (7 to 9 AM and 5 to 7 PM weekdays) constitute the most likely times that pedestrian accessibility and safety may be at issue. On the weekend, vehicular traffic on local streets in the area of South Station and Back Bay is relatively uncongested. It is during the weekday morning and afternoon peak periods that the largest volumes of both vehicles and pedestrians circulate in the areas surrounding South Station and Back Bay Station.

Table 4.9-3 indicates the proposed 2010 Amtrak schedule of trains. During the morning peak, one Amtrak train arrives at South Station and Back Bay Station and three trains depart. In the evening peak, three Amtrak trains arrive and three depart from each of the two stations.

Passengers walking to South Station and Back Bay Station for the six peak period trains headed toward New York (three in the AM and three in the PM) are less likely to incur accessibility and safety concerns. Passengers trickle into South Station and Back Bay Station either before their train pulls into the station or while their train sits waiting at the platform. Given the time interval between departing trains, generally a minimum of 15 minutes, not many passengers will be walking to the station from any single direction at the same time.

However, when trains arrive from New York into Back Bay Station and South Station, passengers unload and depart the station in shorter time "pulses" in greater numbers. Four peak period trains arrive at Back Bay and South Stations (one in the AM and three in the PM).

The most likely time for conflicts between Amtrak and commuter rail passengers occurs during the evening peak period as commuter rail passengers access the stations to leave the city, while Amtrak passengers attempt to egress from the stations into the city. However, at this time of day, the volume of business passengers arriving at Back Bay and South Stations is probably low since normal work hours are ending.

Pedestrian Facilities Accessing South Station: In conjunction with the refurbishing of South Station, the MBTA has constructed new and upgraded pedestrian facilities in the immediate vicinity of South Station. Pedestrians can enter the upper, unpaid area of the MBTA Red Line South Station subway stop from inside the railroad station and gain access to any of the station's exits, one on each of the four corners of the intersection of Summer Street and Atlantic Avenue. Pedestrians can safely cross the intersection via the underground facilities and have ready access to public transportation, taxi stands, downtown Boston, and the Peter Pan bus terminal. In addition, pedestrians can cross Summer Street and Atlantic Avenue at street level. Traffic signals at the intersection adjacent to South Station have pedestrian phases to accommodate safe movement across both Summer Street and Atlantic Avenue.

Pedestrian Facilities Accessing Back Bay Station: As part of the Orange Line relocation, the MBTA has also improved pedestrian circulation in the area of Back Bay Station. Pedestrian access across Dartmouth Street to/from Back Bay Station is available both at street level and in a tunnel below grade, without entering the paid area of the MBTA Orange Line subway stop. For Tracks 1, 2, and 3, pedestrians can also access Clarendon Street directly from/to the station platforms. Emergency access between Berkeley Street and these platforms is also available.

Grade Crossings. The effects of the Proposed Action and the planned 2010 train schedule on vehicle delay at individual grade crossings would be minor, with increases ranging from 2.5 seconds at Walker's Dock, Freeman's Crossing, and Palmer Street to 5 seconds at Bank Street, State Street, and Governor Winthrop's Boulevard. Vehicle delay associated with the No-Build Alternative - FF-125 and FRA-150 scenarios would be roughly the same.

Commuter Rail. The commuter railroads operating over the Northeast Corridor plan to significantly increase service over the next several years. Table 4.9-7 presents the increased frequency of trains projected by these agencies.

TABLE 4.9-7 Commuter Rail Traffic

NEC ROUTE SEGMENT	TRAINS PER DAY	
	Existing	2010
South Station Movements	254	524
Boston - Forest Hills	132	248
Forest Hills - Readville	66	212
Readville - Canton	66	158
Canton - Providence	32	72
Providence - Kingston	0	24
Kingston - New London	0	0
New London - Old Saybrook	0	10
Old Saybrook - New Haven	26	36
New Haven - Bridgeport	66	104
Bridgeport - Norwalk	66	110
Norwalk - Stamford	78	150
Stamford - New Rochelle	204	288
New Rochelle - Harold	0	0
Harold - Penn Station	560	778

The increased use of the NEC main line can lead to congestion with implications for the ability of any or all users to provide necessary service. The Proposed Action per se would not significantly impact the capacity of the rail line for use by commuter trains. In certain instances, the speed differential between intercity and commuter trains that will increase as a result of the Proposed Action has the potential of causing capacity conflicts. Such impacts will be addressed by adjusting schedules and a limited restoration of NEC sidetracks as outlined in Chapter 5.

The primary area of concern is the potential impact on NEC capacity of the significantly higher number of intercity trains using the NEC as a result of NECIP as a whole and additional commuter trains planned by the states. This issue was addressed in the Northeast Corridor Transportation Plan (NECTP). Sufficient capacity improvements have been included in that plan to accommodate all users' projected needs (see Table 1.1-1). It

is assumed that the development of these improvements to the NEC would be the same for the Proposed Action or the No-Build Alternative - FF-125 or FRA-150 scenarios. When the states and Amtrak have reached agreements to proceed with a specific improvement, a site specific environmental review will be undertaken as is presently being done with the Shell Flyover at New Rochelle, New York.

There is one intercity/commuter capacity issue that has implications for the No-Build Alternative - FF-125 Scenario. Access to New York City's Pennsylvania Station is via a series of constricted tunnels in which non-electric locomotives must convert to electric power. Presently this is accomplished thorough use of the 600 VDC third rail system. The performance of non-electric trains using that system is significantly worse than electric trains using the overhead catenary. As a consequence, in assigning "slots" for use by trains during peak hours, a non-electric train using third rail uses two slots for each movement compared to one slot used by Amtrak's current AEM-7 electric locomotives or the new electric equipment being acquired for NEC service.[37] These trains would occupy additional capacity at Pennsylvania Station while they are serviced (e.g., seats turned, interiors cleaned) prior to the return trip to Boston unless they were to be serviced at Sunnyside Yard, which would require additional moves in the tunnels.

There is significant demand for the limited available capacity in the New York City railroad tunnels and, as seen in Table 4.9-7, this demand is increasing significantly. By 2010 the available capacity will be accounted for. The inferior performance of the FF-125 Scenario under these conditions may restrict the number of intercity trains that could operate between Boston and New York City during peak hours below the number planned by Amtrak. This in turn could adversely affect ridership under this scenario. Alternatively, the number of commuter trains could be restricted with adverse implications for commuter ridership and related concerns in the New York City region.

FRA's high-speed non-electric locomotive program intends to address issues concerning dual mode power. This is due, in part, to the importance of the New York City tunnels for other high-speed corridors (such as the Empire Corridor). It is also due to the trend of other regions with air quality problems, such as Los Angeles, to explore requiring electric railroad operations in the region. As a consequence, it is assumed that under the No-Build Alternative - FRA-150 Scenario, the improved non-electric locomotive would have performance equivalent to the electric train operation.

Freight Rail. The Proposed Action per se would not significantly impact the capacity of the rail line for use by freight trains other than during construction and due to the differential speed between high-speed intercity trains and freight trains. These potential impacts are addressed in the mitigation measures required as part of this FEIS/R in Chapter 5.

As with commuter rail, however, the increased demand for intercity and commuter rail access to the NEC can lead to congestion that could, in turn, affect the ability of freight carriers, specifically the Providence and Worcester Railroad (P&W), to maintain its existing freight service to customers on the NEC mainline in Connecticut and Rhode Island if additional capacity is not provided on the NEC main line.

Increased congestion on the NEC main line does not result from the Proposed Action alone. Rather, it would reflect the general increase in intercity traffic that will result from the NECIP program as a whole, from state initiatives to improve commuter rail service on the NEC and from growth in freight service anticipated by the P&W. As such, the potential for impact in this area under the No-Build Alternative - FF-125 and FRA-150 scenarios is essentially the same as with the Proposed Action.

No adverse impacts are expected on the limited Conrail operation in Massachusetts because (1) customer locations involve switching operations along an extensive network of sidetrack and thus avoid conflict with main line intercity passenger train movements; (2) present and proposed sidings will reduce freight train interference with Amtrak and commuter trains; and (3) Conrail freight movements between Attleboro and Mansfield consist of freight with origins and destinations well outside the high speed passenger route.

An analysis was undertaken to estimate the potential impact on freight traffic if no measures to mitigate this potential impact were undertaken. It is unclear how much freight will move in the future and to what extent potential adverse impacts on rail service would translate into shifts to trucks rather than continuation of rail operations or reductions in the total freight volume moved. The freight volumes considered in this discussion assumes 2.0 percent and 8.8 percent annual freight growth rates. The latter assumption represents growth in freight traffic which is substantially higher than recent trends.

To address uncertainties of diversion, two scenarios were analyzed. Under the first scenario, there would be a 25 percent shift of the 2010 freight to trucks. Under the second, there would be a 50 percent shift. The results of this analysis are summarized in Table 4.9-8.

TABLE 4.9-8 Truck Trips in Various Freight Rail Growth and Mode Shift Scenarios, Connecticut and Rhode Island, 2010

MODE SHIFT	25%		50%	
Annual Freight Rail Growth	2.0%	8.8%	2.0%	8.8%
State	**Truck Trips**			
Connecticut	21,564	64,597	43,127	129,194
Rhode Island	10,362	31,040	20,724	62,080
TOTAL	31,912	95,595	63,823	191,190

Source: DMJM/Harris, 1994

Review of Amtrak rail operation simulations of the NEC without additional capacity indicates that Amtrak's 2010 passenger train schedule would reduce by 20 percent the time available to provide freight rail service to P&W's existing customer base at existing volume levels. Additional operating impacts are projected if freight rail volumes increase. Given the potential for service delays at existing and projected freight volumes absent capacity improvements, price increases of at least 5 percent may be expected.

Analysis of a survey of existing and projected freight rail use in the NEC (see Chapter 3 of Volume II for a detailed discussion of this survey) indicated that rail price increases of as little as 5 percent would result in aggressive cost cutting measures by freight rail users including, but not limited to, shifts away from rail to truck, and reevaluation of company hiring practices and investment decisions. Given small price differences between truck and rail for the short-haul rail movements constituting the bulk of NEC rail activity, 75 percent of the firms surveyed predicted that truck usage increases of greater than 25 percent would accompany rail price increases above 10 percent.

Assuming the annual growth rate in freight rail use of 8.8 percent projected by P&W, a shift of 25 percent of NEC freight rail car volumes to truck would generate 95,000 additional annual truck trips in 2010 (see Table 4.9-8). This would result in the annual generation of 48,000,000 VMT nationally, with corresponding air quality and energy consumption impacts. At the same annual growth rate, a 50 percent freight mode shift would generate 191,000 additional 2010 truck trips, corresponding to an annual VMT increase of

96,000,0000 miles. The potential socioeconomic impacts of this mode shift are summarized in Section 4.2.2 of the FEIS/R.

As discussed earlier, measures to mitigate impacts on freight service as a result of the Proposed Action are identified in Chapter 5. Simulations conducted for FRA indicate that with these capacity improvements, existing and proposed intercity and commuter schedules can be accommodated without any significant degradation of the freight service presently provided. The potential for diversion of freight movements from rail to truck as a result of the preferred alternative would be minimal.[38]

Another issue raised in the DEIS/R is the possible impact of electrification on the possible efforts to increase freight rail clearances at some point in the future. Amtrak has agreed to design its system to accommodate any future efforts to improve freight clearances. This includes catenary pole heights and spacings sufficient to permit the larger dimensioned freight cars. Amtrak has also expressed its willingness to cooperate with state agencies or private railroads interested in raising overhead bridges to accommodate increased clearances.[39] These measures are discussed in Chapter 5. No significant impacts in this area are expected as a result of the Proposed Action. The EIS being prepared by RIDOT, FHWA, and FRA that was described above will include an analysis of the alternatives for providing increased clearances for freight cars over the NEC between the proposed port development at Quonset Point/Davisville, RI, and Central Falls, RI.

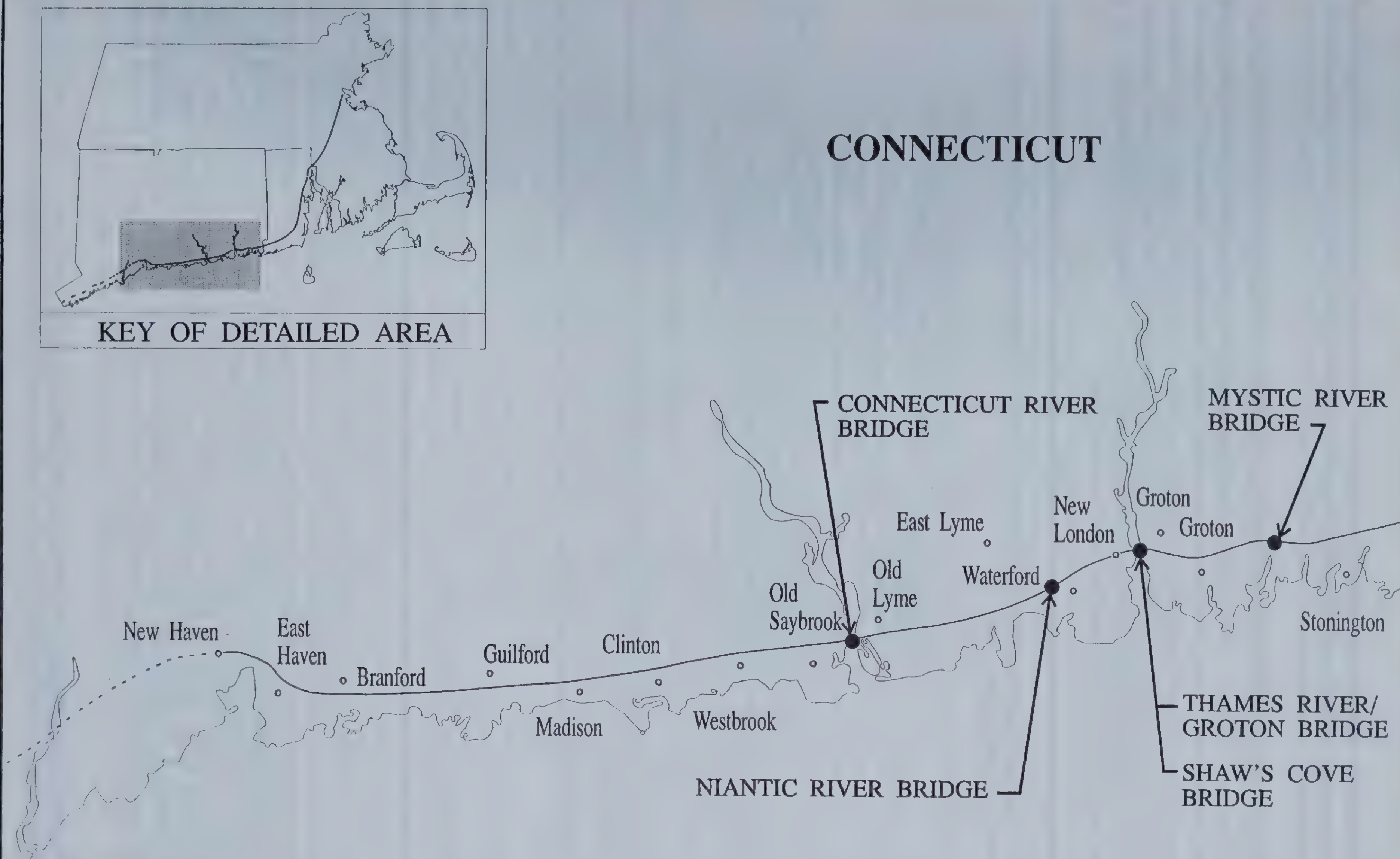
Marine Industry in Coastal Connecticut. Projected train movements at the five bridges (located in Figure 4.9-1) in 2010 are presented in Table 4.9-9. The projected increase in Amtrak intercity service to 26 round-trip trains (52 bridge crossings) per day is readily apparent in this table. Shore Line East commuter rail service is scheduled to extend beyond Old Saybrook to New London by 2010 and would affect three bridges -- the Connecticut River, Niantic River, and Shaw's Cove bridges. Freight rail service is also expected to grow slightly, but could most likely be handled in longer trains rather than additional trains.

TABLE 4.9-9 Railroad Movements, Typical Weekday, 2010

BRIDGE	RAILROAD MOVEMENTS ACROSS BRIDGE			
	AMTRAK (intercity)	SHORE LINE EAST (commuter)	P&W RR (freight)	TOTAL
Connecticut River	54	10	4	68
Niantic River	54	10	4	68
Shaw's Cove	54	10	4	68
Thames River	52	0	4	56
Mystic River	52	0	2	54

Sources: FRA, *Draft Master Plan*, Appendix H, 1993
ConnDOT, Fax transmittal dated May 6, 1993 to DMJM/Harris
P&W, P&W letters dated December 14, 1992 and February 8, 1994 to DMJM/Harris

Analyses indicate that all five bridges will be closed much more frequently and for longer periods in 2010 than at present. The frequency and longer duration of bridge closures would be most pronounced in the morning and afternoon peak travel periods, reflecting projected daily intercity demand for travel as well as the introduction of Shore Line East commuter traffic. The bridge closings correspond with similar peaking patterns in marine traffic as well, although marine patterns are less pronounced than commuter rail patterns.



CONNECTICUT MOVEABLE BRIDGES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 4.9-1

As with the commuter and freight rail operations discussed above, the projected impacts are not the direct result of the Proposed Action per se but from increase in intercity rail operations that would occur with either the FF-125 Scenario or the FRA-150 Scenario.

Existing Coast Guard regulations in effect at the bridges specifically state in a number of instances that [maritime] delays should not exceed 20 minutes. One criterion for projecting impacts is the number of times during a day that there is the potential that Amtrak could not open a bridge within 20 minutes. Table 4.9-10 presents the number of periods during a typical weekday that Amtrak may not be able to open a bridge in the 20-minute period provided in the Coast Guard's regulations. The information in this table was derived from a simulation of rail operations on the NEC main line that was developed with a view of optimizing rail operations. As a consequence, use of this information should be viewed as worst-case.

TABLE 4.9-10 Projected Maritime Delays at Bridges in Excess of 20 Minutes, 4 AM - 12 Midnight, Typical Weekday, 2010

BRIDGE	AVERAGE DAILY OPENINGS, MAY-OCT[1]	POTENTIAL DELAYS IN BRIDGE OPENINGS (4 AM - 12 Midnight)	
		PERIODS	TOTAL EXCESS TIME OVER 20 MINUTES (min)
Connecticut River	14.22	9	228
Niantic River	14.06	8	213
Shaw's Cove	9.43	9	199
Thames River	8.05	7	104
Mystic River	14.22	5	90

Note: [1]Based on 1993 data.

Source: DMJM/Harris from FRA data, 1994

Three bridges -- the Connecticut River Bridge, the Niantic River Bridge, and the Shaw's Cove Bridge -- are projected to have eight to nine periods during a typical weekday in 2010 when a bridge may not be able to open in the 20 minutes provided in the Coast Guard regulations. The potential for delays at the Mystic and Thames River bridges would be somewhat less. As indicated in Table 4.9-9, the number of Amtrak intercity and freight trains across the latter two bridges differs only slightly from the volumes over the other three bridges. What is apparent from Tables 4.9-9 and 4.9-10, however, is the influence of the 10 Shore Line East commuter trains across the Connecticut River, Niantic River, and Shaw's Cove bridges. The commuter trains have a greater impact than their numbers would indicate since they are clustered around morning and evening rush hours and are responsible for extending the length of time bridges must be closed at popular times for mariners to use bridges.

In summary, the total marine windows and estimated boat capacity for typical weekdays in 1993 and 2010 are compared in Table 4.9-11. The projected 2010 train schedules would result in decreased marine windows and

would thus reduce the volume of boats which could pass through the bridges. At today's level of boating activity, mariners would be impacted by 2010 passenger train schedules. As boat volumes increase, these projected impacts would increase. The economic implications of these impacts are discussed in Section 4.2.2.

TABLE 4.9-11 Total Estimated Boat Capacity, 7 AM to 7 PM, Typical Weekday, 1993 and 2010

BRIDGE	TOTAL MARINE WINDOWS (7AM to 7PM) (min)		ESTIMATED CAPACITY FOR BOAT PASSAGES, EACH DIRECTION[1]	
	1993	2010	1993	2010
Connecticut River	576	317	1,152	634
Niantic River	559	316	1,118[1]	632[1]
Shaw's Cove	554	284	1,108	568
Thames River	573	350	1,146	700
Mystic River	571	387	1,142	774

Notes: [1]Two boats per minute per direction, with the exception of the Niantic River bridge, where open water conditions frequently permit only single-lane movement through the bridge.
[2]As boat passages are derived from the total marine windows, the percent decrease applies to the changes in both marine windows and boat passages.

Source: DMJM/Harris from FRA data, 1994

Despite the additional time that bridges are required to be closed for train passages, there are sufficient periods of time in most hours to permit opening of the bridges for marine access. In addition, a number of projects included in the NECTP, such as improved signalling and new equipment that will make rail service more reliable and the proposed replacement of the bridges at Niantic and Groton that will make their operation more reliable, will tend to mitigate some of the adverse impact in this area. The Coast Guard has indicated that necessary marine access should be possible with the development of a bridge operating plan that addresses train schedules, bridge maintenance, signals and train controls, better information to mariners, and other related issues. Amtrak will work with the Coast Guard and other interested parties to develop this plan and will not significantly increase the frequency of rail operations until a plan is developed to minimize disruption to marine traffic. Such a plan would mitigate a substantial portion of the adverse impacts of NECIP in this area.

Coordination with the Central Artery/Tunnel Project. The Central Artery/Third Harbor Tunnel (CA/T) Project is a major Massachusetts Highway Department (MHD) transportation improvement project currently under design and construction in Boston, Massachusetts. The CA/T Project's main purpose is to improve both the capacity and safety of existing facilities in the Project area. The Project has two main segments: the Central Artery (I-93) is to be reconstructed underground through Boston's downtown area, and the Massachusetts Turnpike (I-90) will be extended to Logan International Airport via a cross-harbor tunnel. The underground highway will have additional lanes, improved roadway geometries, and improved acceleration and deceleration lanes to accommodate greater traffic capacity and improve traffic safety.

Complicated planning, design, and construction issues will result from the construction of CA/T Project highway elements in Boston immediately over, under, and adjacent to railroad lines to be electrified by the Proposed

Action. The simultaneous design and construction of these Proposed Action and CA/T Project elements would impact CA/T Project planning and design, and may impact the CA/T Project's construction schedule. A lack of sufficient design detail, and the absence of a fixed, defined CA/T construction schedule, precludes full definition of potential Proposed Action impacts.

Potential impacts extend from Back Bay Station to South Station, and on the MBTA Dorchester Branch from South Station to Amtrak's Southampton Yard. The work in this area would occur over, below, and adjacent to property and structure where the CA/T Project will design and construct the I-93 and I-90 north and southbound interchanges, the I-93 and I-90 Interchange railroad relocations, the Massachusetts Avenue interchange, and the South Boston Bypass Road (see Figures 4.9-2 and 4.9-3). Simultaneous construction of the Proposed Action and the CA/T Project in this geographic area is anticipated. Biweekly working sessions, staffed by Amtrak and CA/T Project personnel, are underway in an effort to anticipate, evaluate, and resolve planning, design, and construction issues.

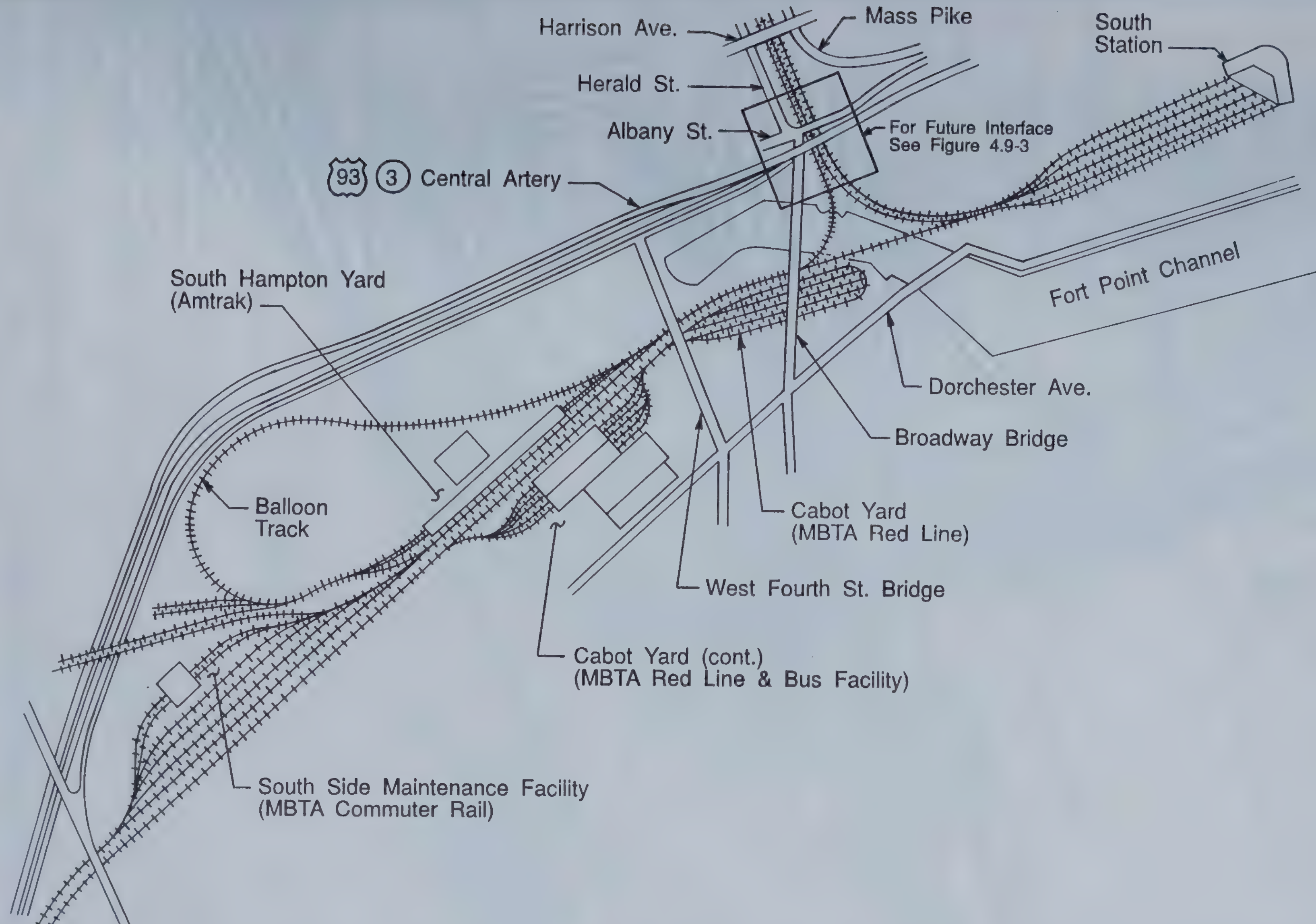
According to MHD, two elements of the Proposed Action could precipitate CA/T Project impacts. The first is the Proposed Action's use of a catenary system from the Roxbury substation east to serve as both a power distribution system and a power supply source along the NEC and within Amtrak's maintenance facilities at Southampton Yard, and the planned attachment of this system to the Harrison Avenue bridge, the Harrison Avenue utility bridge, and the Albany Street bridge. The second is the installation of barriers on all overhead bridge structures.

The Proposed Action's planned attachment of the catenary system to area bridges requires that CA/T Project staff plan for subsequent construction work in close proximity to electrified catenary wires. In addition, the dual role to be played by the catenary system may also reduce prospective CA/T construction windows. Currently, CA/T Project bridge construction requires coordination with Amtrak and MBTA train schedules and is not dependent on the operation of Amtrak's 24-hour Southampton Yard maintenance and layover facility. Because the Proposed Action's catenary system would supply energy to Southampton Yard, CA/T construction schedules in the future would have to be coordinated with both passenger rail movements and with Amtrak maintenance schedules. Given that the power system serving the Southampton Yard must be shut down to allow for CA/T Project work, available construction windows could be reduced. Absent detailed information about CA/T Project schedules, however, it is not possible to conclude that reduced windows would necessarily result in construction schedule or cost impacts. Amtrak and the CA/T Project managers have agreed to coordinate their efforts to minimize conflicts. Finally, the Proposed Action's planned installation of barriers the full length of bridges in the CA/T Project area may result in structural and visual impacts on CA/T Project bridges currently under design and construction.

4.9.3(b) Construction Period Impacts

Traffic Patterns and Operations During Bridge Modifications. In order to obtain adequate clearance for the installation of the catenary, 17 overhead roadway bridges would be raised, replaced or demolished. Of these, the following 10 are programmed for replacement or reconstruction by the states of Connecticut, Rhode Island, or Massachusetts, and are evaluated in other documents:

- Old Clinton Road, Westbrook, CT
- Mason Island Road, Stonington, CT
- Main Street, Westerly, RI
- Carolina Street, Charlestown, RI
- Maintonomi Rt 2, Richmond, RI
- Main Street, South Kingstown, RI
- Roger Williams, Providence, RI
- Conant Street, Pawtucket, RI
- Thatcher Street, Attleboro, MA
- Depot Street, Sharon, MA



NEC/CA/T EXISTING CONDITIONS

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 4.9-2

NEC/CA/T FUTURE INTERFACE

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure 4.9-3

As stated in Section 3.9.1, seven bridges are to be modified as part of this project:

- Millstone Road (West), Waterford, CT
- Johnnycake Hill Road, Old Lyme, CT
- Burdickville Road, Charlestown, RI
- Kenyon School Road, Richmond, RI
- Park Avenue, Cranston, RI
- Pettaconsett Avenue, Warwick, RI
- Maskwonicut Street, Sharon, MA

The duration of construction for these bridges would range from 1.0 to 4.5 months.

The Johnnycake Hill Road Bridge, which would be replaced, is a pedestrian bridge. Therefore, no impacts to traffic would occur.

Raising or replacement of the Burdickville Road Bridge could be staged so that vehicular traffic would be maintained during construction, by regulating traffic with signals at either end of the bridge. At any given time, traffic flow across the bridge could be permitted in one direction only. Traffic volumes on this bridge are very light (daily: 349; AM peak: 19; PM peak: 30) and any adverse traffic impacts during the short 4-month construction period would be minor.

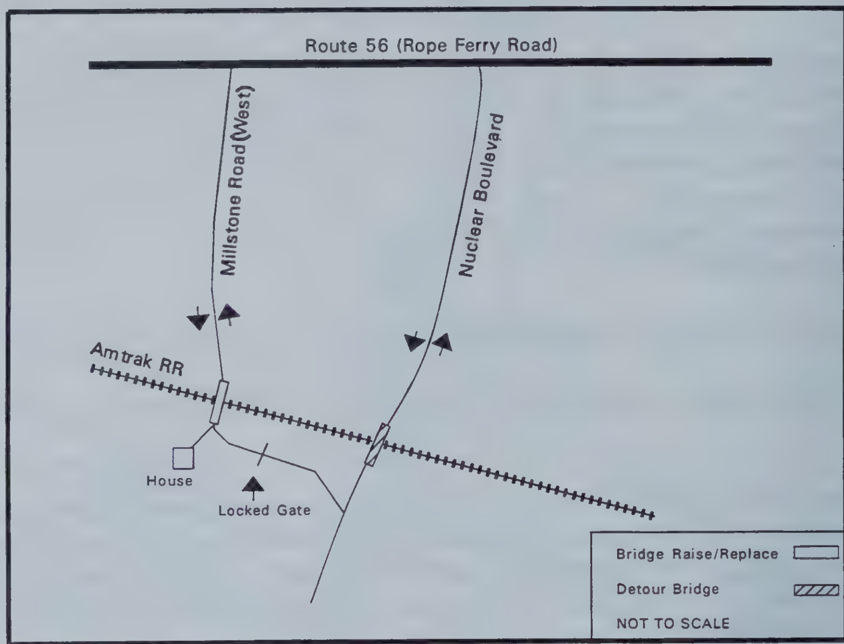
Construction at Millstone Road (West), Kenyon School Road, Park Avenue, Pettaconsett Avenue, and Maskwonicut Street bridges could not be staged to keep part of the bridge open. Therefore, alternative traffic routes could mitigate these impacts for the duration of construction from 2.5 to 4.5 months. An alternative/detour route to which traffic could be diverted during construction has been identified for each of the five bridges (see Figures 4.9-4 through 4.9-6). Traffic operations at six intersections along these detour routes were analyzed to determine the effects of the diverted traffic on existing traffic operations, and the results of these analyses are tabulated in Table 4.9-12. Amtrak will work with the appropriate local authorities to facilitate these detours.

The diversion of traffic associated with the Millstone Road (West), Kenyon School Road, and Maskwonicut Street Bridges would have no adverse impact. Millstone Road West (also called Millstone Point Road), where it crosses the Amtrak mainline, provides access only to a single residence and a locked gate into the Northeast Utilities (NEU) Millstone Point Nuclear Power Station. Temporary access on the east side of the tracks could be across NEU property. The installation of a temporary fire hydrant on the east side of the tracks would be provided. While Depot Street would form the primary detour route during the raising or replacement of the Maskwonicut Street Bridge, some traffic would likely use Richard's Avenue and Canton Street, despite the 11-foot clearance limitation on the Canton Street Bridge.

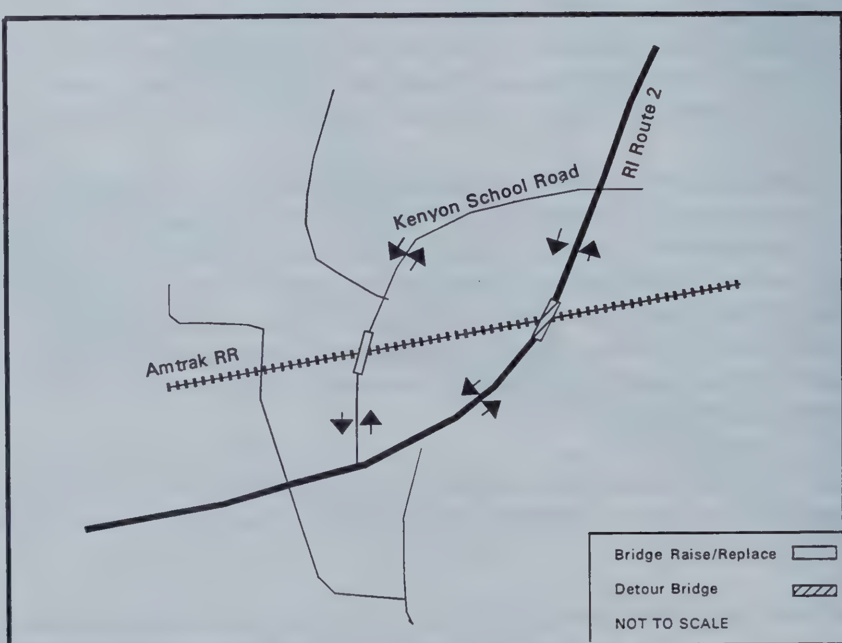
Two intersections along the Park Avenue Bridge detour route were analyzed (see Table 4.9-12). The level of service would improve at the Park Avenue/Elmwood Avenue intersection, and degrade at the Park Avenue/Reservoir Avenue intersection.

According to the local fire chiefs, there would be no adverse effects on emergency response times or services as a result of the temporary detours for the Kenyon School Road, Pettaconsett Avenue, and Maskwonicut Street Bridges. The detour at the Park Avenue Bridge, however, could adversely affect emergency response time and service by adding approximately 1.5 miles and at least 5 minutes to any response on either side of the Amtrak mainline.[40]

Coordination with the MHD CA/T Project. Construction of the Proposed Action would occur within the project limits of the MHD CA/T Project. This will necessitate coordination of construction schedules and other efforts to minimize impacts and ensure the constructability of both of these important projects.

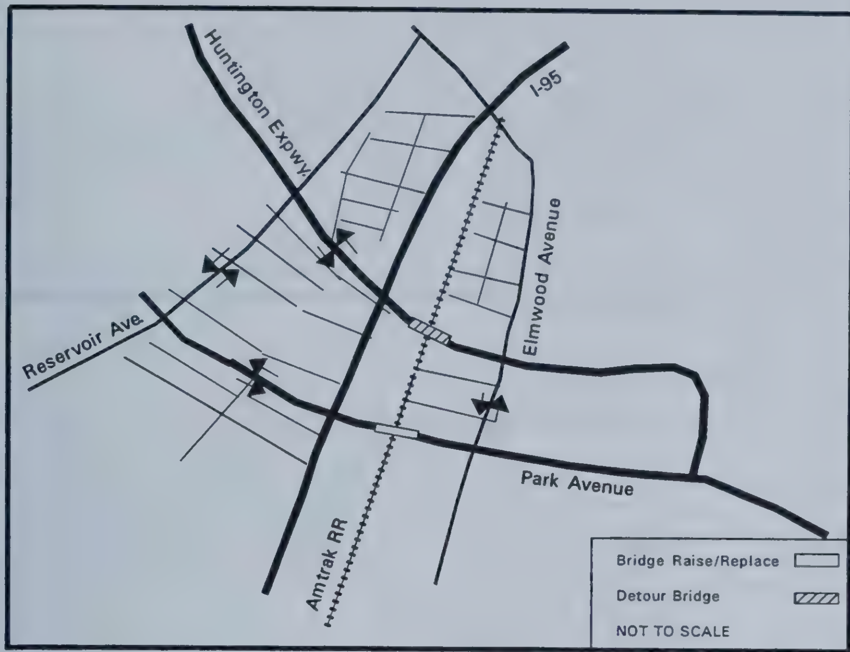


Millstone Road (West)

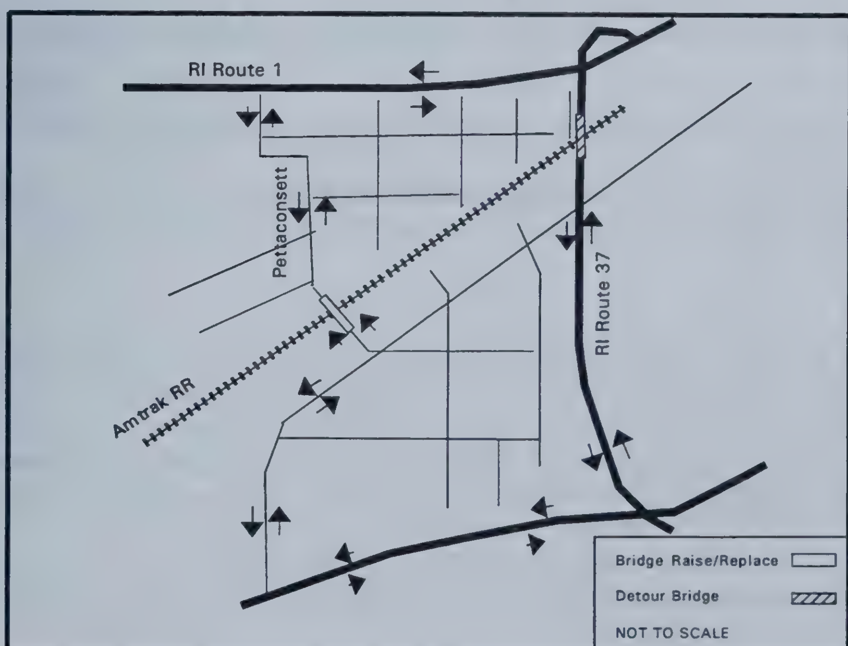


Kenyon School Road

	MILLSTONE ROAD (WEST) AND KENYON SCHOOL ROAD DETOURS	Figure 4.9-4
	Northeast Corridor Improvement Project Electrification - New Haven CT to Boston MA	



Park Avenue

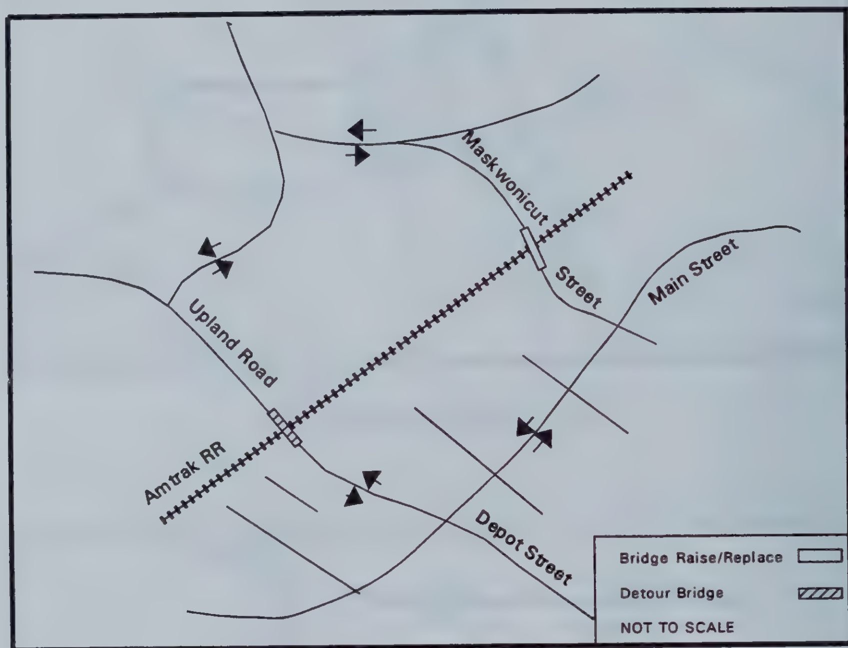


Pettaconsett Avenue

PARK AVENUE AND
PETTACONSETT AVENUE DETOURS

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure
4.9-5



Maskwonicut Street

MASKWONICUT STREET DETOUR

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure
4.9-6

TABLE 4.9-12 Detour Intersection Analysis

BRIDGE	AFFECTED INTERSECTION	AFFECTED MOVEMENT	LEVELS OF SERVICE (Existing/Detour)
Kenyon School Rd. Richmond, RI	Kenyon School Rd./Route 2	eastbound right	A/A
		eastbound left	A/A
		northbound left	A/A
	Main St./Route 2	southbound right	A/A
		southbound left	A/A
		eastbound left	A/A
Park Ave. Cranston, RI	Park Ave./Elmwood Ave.	all	C/B
	Park Ave./Reservoir Ave.	all	D/E
Maskwonicut St. Sharon, MA	Maskwonicut St./N. Main St.	eastbound right	A/A
		northbound left	A/A
	Depot St./Upland St./N. Main St.	all	B/B

Source: DMJM\Harris, 1994

4.10 AIR QUALITY

This section describes the benefits and impacts of the Proposed Action and the No-Build Alternative on air quality in the NEC region. Air quality benefits and impacts are assessed using criteria summarized in Table 4.10-1.

4.10.1 Benefits

The mesoscale (regional) analysis found that the Proposed Action would result in significant reductions in annual mobile source emissions of volatile organic compounds (VOC), oxides of nitrogen (NO_x), and carbon monoxide (CO) -- three key pollutants used by Federal and state agencies in determining air quality and public health standards when compared to the 2010 No-Build baseline (AMD-103 scenario) (see Table 4.10-3; Table 4.10-2 compares the projected 2010 emissions of the Proposed Action with the 1992 emissions for VOC, NO_x, and CO). As shown in Tables 4.10-4, 4.10-5, and 4.10-6, net air pollutant emissions from Amtrak operations are lower for each of these pollutants with the Proposed Action in 2010 than with the base line. In addition, diversion of passengers from air and automobile would result in further reductions of the emissions of these pollutants.

The data in Table 4.10-3 indicate that the Proposed Action passes a major air quality hurdle in all three states: that a proposed transportation project not result in increased VOC, NO_x, or CO emissions over the No-Build condition. Such a requirement is a mandated element in the individual State Implementation Plans (SIP). The Proposed Action would result in reduced emissions for the three pollutants in all three states, thus meeting all three individual SIPs. This is critically important in that New Haven, Providence, and Boston are classified as nonattainment areas for VOC; and Boston and New Haven are classified as nonattainment areas for CO.

TABLE 4.10-1 Air Quality Evaluation Criteria

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Project-generated change in train emissions, automobile emissions at train stations, and auto and aircraft emissions due to modal shifts.	Change in levels of criteria pollutants and levels of pollutant mass emissions.	Exceedance of state or Federal standards for criteria pollutants. Exceedance of State SIP Emissions Limits and percentage reduction impacts.
Project-generated change in truck emissions due to shift from freight rail to trucks.	Change in levels of criteria pollutants and levels of pollutant mass emissions.	Exceedance of State or Federal standards for criteria pollutants.
Project-generated emissions from electrical power plants.	Comparison of the project generated emissions to existing emissions.	None
Construction impacts due to site preparation.	Levels of criteria pollutants below state and Federal standards.	Exceedance of state or Federal standards for criteria pollutants.

Source: K.M. Chng Environmental, Inc., 1993

As indicated in Table 4.10-4, reductions in VOC emissions with the Proposed Action would be attributable approximately equally to automobiles, aircraft, and Amtrak diesel trains, while reductions in NO_x emissions would be due primarily to the switch to electric locomotives, and secondarily to reductions in aircraft flights because of the diversion of passengers from air travel to intercity rail (see Table 4.10-5). Reductions in CO could be attributed approximately equally to changes in aircraft flights and shifts from automobiles to intercity rail (see Table 4.10-6). The net reductions in corridorwide emissions due to the Proposed Action over the No-Build baseline condition (the No-Build Alternative - AMD-103 Scenario) are summarized as follows:

- 202 kilograms per day (kg/day) for VOC (5 percent reduction)
- 1,855 kg/day for NO_x (12 percent reduction)
- 1,007 kg/day for CO (4 percent reduction)

The calculations of air quality for the Proposed Action that show these net benefits are based on air pollutant emissions (from power plants) that used the most conservative assumptions for rail energy consumption identified in Section 4.6. As discussed in that section, under more realistic energy consumption assumptions, rail energy use is only 60 percent of the conservative assumptions. Significant reductions from this lower level of energy consumption may also be possible with the incorporation of regenerative braking into the Proposed Action. It is possible, therefore, that the energy consumption, and hence the air pollutant emissions of the Proposed Action, may be half of those under the conservative assumptions used in this analysis. Under these circumstances, the air quality benefits of the Proposed Action are substantially understated.

The pollutant emissions from the Proposed Action may also be overstated because this analysis did not take credit for power plant-specific emissions reductions which are called for in the Clean Air Act Amendments and other possible initiatives that may take place within the next 15 years.

TABLE 4.10-2 1992 and Projected 2010 Emissions by State for VOC, NO_x, CO, and SO_2

STATE	VOC (Kg/day)			NO_x (Kg\day)			CO (Kg\day)			SO_2 (Kg\day)		
	1992	2010 PROPOSED ACTION	CHANGE	1992	2010 PROPOSED ACTION	CHANGE	1992	2010 PROPOSED ACTION	CHANGE	1992	2010 PROPOSED ACTION	CHANGE
Connecticut	3,565	2,279	-1,286	6,364	5,938	-426	24,132	13,399	-10,733	386	944	+558
Rhode Island	1,282	572	-710	2,239	1,932	-307	7,946	2,780	-5,166	151	469	+318
Massachusetts	1,585	936	-649	4,454	5,826	+1,372	9,141	5,454	-3,687	391	839	+448
TOTAL	6,432	3,787	-2,645	13,057	13,696	+639	41,219	21,633	-19,586	928	2,252	+1,324

Source: KM Chng Environmental, Inc., 1994

TABLE 4.10-3 Projected 2010 Emissions by State for VOC, NO_x, CO, and SO_2, No-Build Alternative - AMD-103 Scenario and the Proposed Action

STATE	VOC (Kg/day)			NO_x (Kg\day)			CO (Kg\day)			SO_2 (Kg\day)		
	NO-BUILD AMD-103	PROPOSED ACTION	CHANGE	NO-BUILD AMD-103	PROPOSED ACTION	CHANGE	NO-BUILD AMD-103	PROPOSED ACTION	CHANGE	NO-BUILD AMD-103	PROPOSED ACTION	CHANGE
Connecticut	2,354	2,279	-75	6,536	5,938	-598	13,727	13,399	-328	536	944	+408
Rhode Island	629	572	-57	2,350	1,932	-418	2,948	2,780	-168	246	469	+223
Massachusetts	1,006	936	-70	6,665	5,826	-839	5,965	5,454	-511	621	839	+218
TOTAL	3,989	3,787	-202	15,551	13,696	-1,855	22,640	21,633	-1,007	1,403	2,252	+849

Source: KM Chng Environmental, Inc., 1994

TABLE 4.10-4 Comparison of Estimated 2010 Daily Mobile Source VOC Emissions by Mode of Travel

SOURCE	NO-BUILD AMD-103 (kg/day)	NO-BUILD FF-125 (kg/day)		PROPOSED ACTION (kg/day)	
		EMISSIONS	CHANGE FROM NO-BUILD AMD-103	EMISSIONS	CHANGE FROM NO-BUILD AMD-103
Auto	3,417[1]	3,382[1]	-35	3,348[1]	-69
Aircraft	328	262	-66	256	-72
Amtrak	68	129	+61	0	-68
Other Trains	154	154	0	154	0
Buses	22	22	0	22	0
Power Generation	0	0	0	7	+7
TOTAL	**3,989**	**3,949**	**-40**	**3,787**	**-202**

Notes: [1]Improvements from 1992 due to Federal Motor Vehicle Emissions Control Program (FMVCP) and the state Inspection and Maintenance (I/M) programs

Source: K.M. Chng Environmental, Inc., 1994

TABLE 4.10-5 Comparison of Estimated 2010 Daily Mobile Source NO_x Emissions by Mode of Travel

SOURCE	NO-BUILD AMD-103 (kg/day)	NO-BUILD FF-125 (kg/day)		PROPOSED ACTION (kg/day)	
		EMISSIONS	CHANGE FROM NO-BUILD AMD-103	EMISSIONS	CHANGE FROM NO-BUILD AMD-103
Auto	6,168[1]	6,105[1]	-63	6,044[1]	-124
Aircraft	1,925	1,427	-498	1,310	-615
Amtrak	2,221	1,276	-945	0	-2,221
Other Trains	5,041	5,041	0	5,041	0
Buses	196	196	0	196	0
Power Generation	0	0	0	1,105	+1,105
TOTAL	**15,551**	**14,045**	**-1,506**	**13,696**	**-1,855**

Notes: [1]Improvements from 1992 due to Federal Motor Vehicle Emissions Control Program (FMVCP) and the state Inspection and Maintenance (I/M) programs

Source: K.M. Chng Environmental, Inc., 1994

TABLE 4.10-6 Comparison of Estimated 2010 Daily Mobile Source CO Emissions by Mode of Travel

SOURCE	NO BUILD AMD-103 (kg/day)	NO BUILD FF-125 (kg/day)		PROPOSED ACTION (kg/day)	
		EMISSIONS	CHANGE FROM NO-BUILD AMD-103	EMISSIONS	CHANGE FROM NO-BUILD AMD-103
Auto	20,208[1]	19,998[1]	-210	19,800[1]	-408
Aircraft	1,665	1,248	-417	1,180	-485
Amtrak	196	423	+227	0	-196
Other Trains	442	442	0	442	0
Buses	129	129	0	129	0
Power Generation	0	0	0	81	+81
TOTAL	**22,640**	**22,240**	**-400**	**21,632**	**-1,008**

Notes: [1]Improvements from 1992 due to Federal Motor Vehicle Emissions Control Program (FMVCP) and the state Inspection and Maintenance (I/M) programs.

Source: K.M. Chng Environmental, Inc., 1994

4.10.2 Impacts

4.10.2(a) Environmental Impacts

Proposed Action -- Other Regional Pollutants.

Ozone Formation: Ozone formation does occur in the immediate area of the catenary cable and from sparking between the wheels and rails of an electric powered locomotive. The quantities of ozone formed from sparking from electric locomotives have not been measured; however, these amounts are considered to be minute. In fact, ozone resistant materials are used for the pantograph and cabling, and tolerances for gaps between these components are very restrictive in order to minimize corona sparking, loss of power, and ozone formation. High-quality, well-maintained wheels and continuous welded rails are also used to minimize sparking and loss of power.

The minuscule amounts of ozone generated in the immediate vicinity of the sparking dissipate rapidly in the ambient air, and are not sufficient to cause measurable increases in the ozone levels in the region.

PM10: PM10 emissions from diesel-powered locomotives are estimated to be about 85 percent lower than CO emissions; from aircraft, about 88 percent lower than CO emissions; from automobiles, about 99 percent lower than CO emissions. PM10 emissions from power plants (assuming that all total suspended particulates are PM10) can be as much as two orders of magnitude larger than CO emissions. Thus, the magnitude of the PM10 emissions being eliminated is very small when compared to the PM10 emissions increases from the power plants.

There is one PM10 nonattainment area along the NEC which covers the city limits of New Haven. Discussions with CT DEP staff indicate that there are currently no power plants within the nonattainment area providing

electricity to the regional power grid nor are there known plans to construct any such plants.[41] Therefore, the Proposed Action would not increase PM10 emissions in this area.

SO_2: The Proposed Action is expected to increase total SO_2 emissions in the NEC by 849 kg/day, a 61 percent increase over the No-Build AMD-103 emissions (see Table 4.10-7). Reductions in emissions occur due to the elimination of the Amtrak diesel-powered locomotives and due to passenger modal shifts from aircraft and automobiles to trains. With the proposed electrification, a new source of emissions associated with power generation (to provide the electrical power for the trains) is introduced. The estimated 1,184 kg/day of SO_2 from this source is quite significant and represents over half of the total emissions of 2,252 kg/day associated with the electrification project.

TABLE 4.10-7 Comparison of Estimated 2010 Daily Mobile Source SO_2 Emissions by Mode of Travel

SOURCE	NO-BUILD AMD-103 (kg/day)	NO-BUILD FF-125 (kg/day)		PROPOSED ACTION (kg/day)	
		EMISSIONS	CHANGE FROM NO-BUILD AMD-103	EMISSIONS	CHANGE FROM NO-BUILD AMD-103
Auto	307	304	-3	301	-6
Aircraft	76	56	-20	52	-24
Amtrak[1]	305	1,855	+1,550	0	-305
Other Trains[1]	693	693	0	693	0
Buses	22	22	0	22	0
Power Generation[2]	0	0	0	1,184	+1,184
TOTAL	**1,403**	**2,930**	**+1,527**	**2,252**	**+849**

Notes: [1]SO_2 emissions based on 0.5 percent sulphur in the diesel fuel.
[2]SO_2 emissions based on 1.0 percent sulphur in Number 6 fuel oil.

Source: CT DEP, RI DEM, MA DEP, 1994

Table 4.10-3 indicates increases in SO_2 levels above the no-build baseline (AMD-103 scenario) for all three states. However, none of the three states has requirements in its SIP mandating SO_2 emissions from proposed transportation projects to be less than the no-build emissions. Thus, no SIP violations are projected.

Toxic Compounds: Due to incomplete data bases, emissions of toxic compounds from diesel-powered locomotives have not been quantified in any detail to date in air quality literature; however, trace levels of toxic compounds emitted from diesel-powered vehicles include: acetaldehyde, benzene, ethyl benzene, formaldehyde, toluene, xylenes, and 1,3-butadiene. Other compounds emitted from transportation sources which are considered to be toxic include: acetonitrile, acrolein, acrylic acid, ethylene dichloride, hexane, methyl ethyl keytone, naphthalene, phenol, and styrene, among others.

The potential increases in SO_2 emissions with the Proposed Action, over the No-Build AMD-103 emissions, are minor. The potential for exceedance of the SO_2 ambient air quality standards is expected to be quite minimal.

Toxic compounds emissions are addressed in this FEIS/R in a qualitative rather than a quantitative manner for two reasons: (1) the emissions data base for toxic compounds emissions is not as complete nor as factual as data bases relating to other compounds such as CO and VOCs, and (2) while some pioneering analyses have been and are being undertaken in certain areas of the U.S., such work has not been fully endorsed by the air quality technical community to date. A number of assessments are cited in the air quality literature which use total VOC emissions as a proxy for toxic compounds emissions, and such a qualitative assessment was performed for this FEIS/R.

Given that the Proposed Action is projected to reduce total VOC emissions by about 5 percent, primarily due to the elimination of diesel-powered locomotives from the NEC and reduction in aircraft operations and passenger vehicle trips, toxic compounds emissions are projected to decrease as well. Although the quantification of toxics emissions is not analyzed in this FEIS/R, it is presumed that the anticipated reduction in toxic emissions due to the elimination of diesel-powered locomotives and reduced aircraft operations and auto trips will more than offset a concurrent increase in emissions of toxic compounds from power plants generating electricity for the project.

Section 112(n) of the Clean Air Act directs the EPA to conduct a study of hazardous air pollutant emissions from electric utility steam generating units. On the basis of that study, the EPA Administrator will determine whether further regulation of toxic air pollutants from such generating units is appropriate and necessary to protect the public health, even after the requirements the Clean Air Act Amendments imposed on utilities have been implemented. Therefore, if such emissions are found to be of concern, they will be addressed through the EPA regulatory process.

Proposed Action -- Site-Specific Analyses.
CO Impacts near the Route 128 Express Station: Estimated maximum 1-hour and 8-hour CO concentrations for 1992, the Proposed Action and the No-Build Alternative - AMD-103 Scenario, are exhibited in Table 4.10-8 for the intersection of University Avenue and Blue Hill Drive, and in Table 4.10-9 for the intersection of Blue Hill Drive and Route 128 South ramps.

Despite higher traffic volumes at both intersections generated by the increased ridership in the Proposed Action, no violations of the 9-ppm standard are expected. Maximum 1-hour CO concentrations are estimated from the 8-hour results by use of an inverse persistence factor. Similarly, no violations of the 1-hour standard of 35 ppm are anticipated in 2010 from the Proposed Action.

All alternatives are expected to benefit equally in the dramatic drop in 8-hour and 1-hour CO concentrations between 1992 and 2010. The projected reductions in concentrations are due to projected major reductions in emissions resulting from the implementation of the Federal Motor Vehicle Emissions Control Program (FMVCP) and the Massachusetts Inspection and Maintenance (I/M) programs.

Locomotive Pass-Bys: As electric locomotives do not emit CO or NO_2, there are no impacts to specific receptors along the corridor due to locomotive pass-bys.

Proposed Action -- Clean Air Act Conformity. Each of the three states through which the Proposed Action passes has nonattainment areas with respect to one or more NAAQS. As a result, FRA considered whether a conformity determination was required pursuant to the Environmental Protection Agency's General Conformity Rule (40 CFR Part 51, Subpart W) described in Section 3.10.1(a). FRA is required to make a specific determination of whether the Proposed Action is in conformity with the applicable SIPs only if it will cause emissions within nonattainment or maintenance areas which equal or exceed the de minimis levels described in 40 CFR § 51.853(b). In determining whether the Proposed Action has the potential to exceed the de minimis thresholds, emissions caused by and occurring at the same time and place as the Federal action itself ("direct" emissions as defined in 40 CFR §51.852), and emissions from other sources of air pollution which are caused

by the electrification project, are reasonably foreseeable (even if removed from the project in time or distance), and which can be practicably controlled by the FRA under its continuing program responsibility ("indirect" emissions as defined in 40 CFR §51.852) must be added together. If the sum of the direct and indirect emissions

TABLE 4.10-8 Estimated Maximum 8- and 1-Hour CO Concentrations[1] at the Intersection of University Avenue and Blue Hill Drive, 1992 and 2010

RECEPTOR LOCATION	1992		2010 NO-BUILD AMD-103		2010 PROPOSED ACTION	
	8-HOUR	1-HOUR	8-HOUR	1-HOUR	8-HOUR	1-HOUR
R1 Westwood Office Park	5.7	9.6	2.7	4.6	2.8	4.8
R2 Rt. 128 Train Station	4.0	6.7	1.9	3.3	2.0	3.5
R3 General Motors Bldg.	4.3	7.2	2.2	3.8	2.2	3.8
R4 Blue Hill Rd. EB @ 10m	9.4[2]	15.9	4.5	7.7	4.8	8.2
R5 Blue Hill Rd. EB @ 20m	9.4[2]	15.9	4.0	6.9	4.3	7.4
R6 Blue Hill Rd. EB @ 40m	9.4[2]	15.9	3.4	5.8	3.7	6.3
R7 University Ave. SB @ 10m	6.1	10.3	6.7	11.4	7.1	12.1
R8 University Ave. SB @ 20m	6.7	11.3	6.0	10.3	6.8	11.6
R9 University Ave. SB @ 40m	6.0	10.1	4.2	7.2	4.6	7.9
R10 University Ave. NB @ 10m	9.3[2]	15.7	4.8	8.2	4.9	8.4
R11 University Ave. NB @ 20m	8.7	14.7	4.6	7.9	4.7	8.0
R12 University Ave. NB @ 40m	7.9	13.3	4.2	7.2	4.4	7.5
R13 Green Lodge Rd. WB @ 10m	N/A[3]	N/A	5.2	8.9	5.4	9.2
R14 Green Lodge Rd. WB @ 20m	N/A	N/A	4.0	6.9	5.1	8.7
R15 Green Lodge Rd. WB @ 40m	N/A	N/A	3.2	5.5	4.1	7.0

Notes: [1]Concentrations are in parts per million (ppm). The Federal and Massachusetts 8- and 1-hour standards are respectively 9 and 35 ppm.
[2]These entries represent violations of the standards.
[3]N/A means not applicable.

Source: KM Chng Environmental, Inc., 1993

TABLE 4.10-9 Estimated Maximum 8- and 1-Hour CO Concentrations[1] at the Intersections of Blue Hill Drive and Route 128 South Ramps, 1992 and 2010

RECEPTOR LOCATION	1992		2010 NO-BUILD AMD-103		2010 PROPOSED ACTION	
	8-HOUR	1-HOUR	8-HOUR	1-HOUR	8-HOUR	1-HOUR
R1 Residence A	4.7	7.8	2.7	4.6	2.8	4.8
R2 Residence B	3.7	6.2	2.5	4.3	2.6	4.5
R3 Residence C	3.3	5.5	2.5	4.3	2.6	4.5
R4 Westwood Office Park	3.8	6.4	2.5	4.3	2.5	4.3
R5 Blue Hill Rd. EB @ 10m	7.0	11.8	4.0	6.9	4.1	7.0
R6 Blue Hill Rd. EB @ 20m	7.3	12.3	3.9	6.7	3.9	6.7
R7 Blue Hill Rd. EB @ 40m	6.2	10.4	3.7	6.3	3.8	6.5
R8 Rt. 128 SB Off-Ramp @ 10m	4.7	7.9	3.2	5.5	3.3	5.7
R9 Rt. 128 SB Off-Ramp @ 20m	4.2	7.0	3.3	5.7	3.3	5.7
R10 Rt. 128 SB Off-Ramp @ 40m	3.8	6.4	3.1	5.3	3.2	5.5
R11 Blue Hill Rd. WB @ 10m	5.2	8.7	3.8	6.5	3.9	6.7
R12 Blue Hill Rd. WB @ 20m	5.1	8.6	3.6	6.2	3.7	6.3
R13 Blue Hill Rd. WB @ 40m	4.7	7.9	3.5	6.0	3.6	6.2

Notes: [1]Concentrations are in parts per million (ppm). The Federal and Massachusetts 8- and 1-hour standards are respectively 9 and 35 ppm.

Source: KM Chng Environmental, Inc., 1993

equals or exceeds the de minimis thresholds, then an individual, project-level conformity determination is required. If the sum of the direct and indirect emissions does not equal or exceed the de minimis thresholds and the project is not considered a regionally significant project (i.e., where the sum of direct and indirect emissions of any pollutant do not equal or exceed the de minimis levels but represent 10 percent or more of a nonattainment or maintenance area's total emissions of that pollutant), then the requirements of Subpart W do not apply to the Federal action and no project specific conformity determination is required.

The Proposed Action will cause only negligible direct emissions associated with the rail transportation itself since the switch from diesel-powered locomotives to electric-powered locomotives will eliminate the emissions currently occurring with the existing rail service. The only direct emissions associated with the operation of electric trains are the very negligible amounts of ozone forming in the immediate area of the catenary cable and from sparking between the wheels and rails of an electric-powered locomotive which are discussed in Section 4.10.2(a). There are also some small, temporary emissions associated with construction of the electrical facilities which are discussed in Section 4.10.2(b). Accordingly, FRA has determined that direct emissions from all criteria pollutants from the proposed project are below the de minimis levels of 40 CFR § 51.853(b).

The Proposed Action will result in a net reduction in emissions of criteria pollutants from automobiles and aircraft.[42] Emissions of some criteria pollutants from power plants are expected to increase slightly in connection with the generation of additional power to meet the needs of the electric locomotives. These clearly would not be "direct emissions." Moreover, the amount of these emissions at specific locations within individual nonattainment areas is not quantifiable and thus would not be regarded as "reasonably foreseeable" for the purposes of the General Conformity Rule. Furthermore, FRA cannot practicably control emissions from electric utilities in the exercise of its continuing program responsibility. Accordingly, emissions associated with power plants do not constitute "direct" or "indirect" emissions within the meaning of the General Conformity Rule and are not included in calculations made to determine whether the total of direct and indirect emissions caused by the Proposed Action in a nonattainment area exceeds the applicable threshold that would require FRA to make a conformity determination.

In summary, since the Proposed Action would not cause any "direct emissions" of criteria pollutants, and since there are no "indirect emissions" caused by the Proposed Action, the total of direct and indirect emissions is below the de minimis emission level thresholds specified in the General Conformity Rule. A conformity determination, therefore, is not required (40 CFR § 51.853).

One additional consideration is required under the General Conformity Rule and that involves a determination of whether the Proposed Action is regionally significant. A Federal action for which the total of direct and indirect emissions of any pollutant does not equal or exceed the de minimis levels may still be considered a regionally significant action and therefore required to complete a conformity analysis if the emissions associated with the action represent 10 percent or more of a nonattainment or maintenance area's total emissions of that pollutant. Based on the discussion presented above, FRA has concluded that the Proposed Action will have only minimal direct emissions (small, temporary construction related emissions and minor ozone formation around the catenary cable and from sparking between the wheels and rails of the electric powered locomotive) and no indirect emissions and, thus, project emissions will be less than 10 percent of any nonattainment area's emissions inventory. Accordingly, FRA has determined that the project does not qualify as a regionally significant action.

No-Build Alternative -- Regional Pollutants.
Projected Emissions Levels in 2010: The No-Build Alternative - FF-125 Scenario, while reducing NO_x emissions in the corridor, is projected to exceed the emission levels for the No-Build Alternative - AMD-103 Scenario for VOC and CO (see Tables 4.10-4 through 4.10-6). Thus, violation of one or more of the SIPs is evident. The No-Build Alternative - FF-125 Scenario is also projected to increase SO_2 emissions over the No-Build Alternative - AMD-103 Scenario (see Table 4.10-7), but no standards or requirements exist in any of the SIPs; therefore, no SIP violations are present. The net increases/decreases in emissions for the No-Build Alternative - FF-125 Scenario in comparison to the No-Build baseline (AMD-103 Scenario) are as follows:

- -40 kilograms per day (kg/day) for VOC (1 percent reduction)
- -1,506 kg/day for NO_x (10 percent reduction)
- +400 kg/day for CO (2 percent reduction)
- +1,527 kg/day for SO_2 (109 percent increase)

With regard to the No-Build Alternative - FRA-150 Scenario, FRA intends to address air pollutant emissions as part of its high-speed non-electric locomotive development program. Several potential participants in the program believe there are opportunities for significant reductions of air pollutant emissions over the non-electric prime movers currently in operation and used as the basis of the No-Build Alternative - AMD-103 and FF-125 scenarios. It is possible that the FRA-150 scenario could meet or exceed the SIP requirements of all three states; however, this will not be conclusively known until the prototype is developed and tested.

No-Build Alternative -- Site-Specific Analyses.
CO Impacts near the Route 128 Express Station: Given that the riderships associated with the No-Build Alternative - FF-125 and FRA-150 scenarios are 22 percent and 4.5 percent lower, respectively, than the

Proposed Action, and that traffic will be reduced accordingly, no violations of the 8-hour and 1-hour standards are projected for these alternatives.

Locomotive Pass-Bys: The purpose of this analysis is to demonstrate the effect of locomotive pass-bys on air quality for the No-Build Alternative, and is measured by 1-hour concentrations of CO and NO_2 at specific locations along the corridor. The measured results are then evaluated to determine what the peak, transitory pollution levels could be under the worst meteorological conditions. A description of the methods and components of this analysis is provided in Section 10.3.3 of Volume III of the DEIS/R. Three prototypical sections of track along the NEC, one in each state through which the project passes, were identified and selected for the modeling analysis. The three sections are in Clinton, CT; North Kingstown, RI; and Sharon, MA. These sections were chosen to reflect various combinations of train operating characteristics (for example, power settings and train speeds) and because each section contains a number of sensitive receptors close to the corridor.

The projected 1-hour concentrations of CO and NO_2 are well below standards or health criteria at all sites for the No-Build Alternative; therefore, no impacts are projected for the No-Build Alternative. The results of these analyses are fully detailed in Chapter 7 of Volume II of the FEIS/R.

Projected Air Quality due to Alternative Energy Analysis Assumptions. As noted in Section 4.6.2, a major utility in the region commented that the incremental fuel analysis developed in the DEIS/R was overly conservative in its reliance on fossil fuels to generate electricity for the Proposed Action. The suggestion was made that the projected regional mix of fuels be used. The energy implications of this assumption are detailed in Section 4.6.2; this section reflects the air quality implications of this assumption and uses the energy data detailed in the noted energy section.

The overall mix of fuels has been determined for the year 2008, which is the final year in a forecast prepared for the major utility pool servicing the NEC (*1993 NEPOOL Generation Emissions Analysis*, draft report dated November 30, 1993). The breakdown of energy generated by each of the fuel sources is as follows:

- nuclear 25.2 percent
- hydroelectric 3.5 percent
- imported hydroelectric 2.3 percent
- other fuels (bio-fuels, solid waste) 3.7 percent
- natural gas 27.0 percent
- oil 15.5 percent
- coal 22.9 percent

The results of this analysis are tabulated in Table 4.10-10. Since the contribution of all sources other than Power Generation are the same in either case, only emissions from Power Generation are illustrated in this table. Despite a fuel mix which includes 31 percent of its total from nuclear and hydroelectric energy, two energy sources that do not generate pollutant emissions, the emissions from the base case (the Proposed Action using a fuel mix of natural gas and diesel fuel in equal proportions) and the alternative fuel mix case are approximately the same. The reason lies in the emissions levels of coal-burning power plants. Coal-burning plants emit pollutants at levels greater than either natural gas- or diesel oil-burning plants. Given that the alternative fuel mix contains roughly 23 percent coal, the greater emissions from plants burning coal offset the lack of emissions from nuclear and hydroelectric power plants.

TABLE 4.10-10 Comparison of Air Quality in 2010 in Base Case and Alternative Analyses

POLLUTANT	POWER GENERATION EMISSIONS (kg/day)		
	BASE CASE	ALTERNATIVE FUEL MIX	PERCENT DIFFERENCE
VOC	2,507	2,509	Negligible
NO_x	11,391	11,668	2.4
CO	23,613	23,712	< 1

Source: KM Chng Environmental, Inc., 1994

Air Quality Impacts Due to Rail Freight Diversion. As discussed in Sections 4.6.2(f) and 4.9.3(a), concerns have been expressed that in the absence of measures to add capacity to the NEC main line, increased intercity and commuter rail operations may create capacity constraints on the NEC that will adversely affect freight rail service. This in turn could lead to the shift by shippers from freight rail service to motor carriers. This would have air quality implications because motor carriers have been found to generate more air pollutant emissions per ton-mile than rail freight service.

As discussed in Section 4.9.3(a), the potential for such impacts does not result from the Proposed Action per se, but rather from the general increase in intercity traffic that will result from the NECIP program as a whole, from state initiatives to improve commuter rail service on the NEC, and from growth to freight service anticipated by the P&W. As such, the potential for impacts in this area under the No-Build Alternative - FF-125 and FRA-150 scenarios is essentially the same as with the Proposed Action.

An analysis was performed of the air quality impacts that could result from the potential diversion of rail freight to truck premised upon an assumption that there would be no capacity improvements to the NEC. The results of this analysis are presented in Table 4.10-11.

As can be seen, if adequate measures were not taken to accommodate all users of the NEC, then there are minor air pollution costs that have the potential to offset the air quality benefits of the Proposed Action, particularly if the optimistic projections of freight traffic growth prove valid. However, as discussed earlier, measures to mitigate impacts on freight service as a result of the Proposed Action are identified in Chapter 5. Simulations conducted for FRA indicate that with these capacity improvements, existing and proposed intercity and commuter schedules can be accommodated without any significant degradation of the freight service presently provided. The impact on air quality due to any diversion of freight movements from rail to truck as a result of the preferred alternative would be minimal.

4.10.2(b) Construction Period Impacts

Construction-related activities from the Proposed Action could result in short-term impacts on ambient air quality in the vicinity of the construction site. These potential impacts include fugitive dust emissions, direct emissions from construction equipment and truck exhausts, and increased emissions and dust from construction vehicles on the streets. Six of the 25 electrification facility sites and four of the seven bridge modification sites are located close to residences and other sensitive receptors that may be affected by construction-related air quality impacts. These include: Roxbury Substation; Westbrook Switching Station; Madison, Grove Beach, Noank, and East

Foxboro paralleling stations; and Millstone Road (West), Kenyon School Road, Pettaconsett Avenue, and Maskwonicut Street bridges. The construction-related impacts to air quality from the Proposed Action are considered to be relatively minor. The No-Build Alternative - AMD-103, FF-125, and FRA-150 scenarios would not require the construction of new facilities. Thus, there would be no impact to air quality from these alternatives.

TABLE 4.10-11 Projected 2010 Emissions for VOC, NO_x and CO - 8.8% Freight Rail Growth and Various Mode Shift Scenarios

POLLUTANT	Emissions (kg/day)	
Mode Shift	25%	50%
VOC	17	33
NO_x	143	285
CO	94	188

Source: K. M. Chng Environmental Inc., 1994

4.11 VISUAL AND AESTHETIC EFFECTS

This section provides an evaluation of the potential effects of the Proposed Action and the No-Build Alternative on visually and architecturally sensitive areas in the NEC. As described in Section 3.11, the objectives of this evaluation are to determine the visual effect of the alternatives on views from visually sensitive receptors (VSR) and to determine the compatibility of electrification facilities with the character of architecturally sensitive areas (ASA). As demonstrated in that section and as listed in Table 3.11-1, VSRs are comprised primarily of residences in the coastal areas of Connecticut and Rhode Island where the rail line abuts the Long Island Sound and Greenwich Bay, respectively. The only electrification facility proposed in an architecturally sensitive area is the Roxbury Crossing Substation, although one component of the Noank Paralleling Station could impact nearby ASAs. Table 4.11-1 describes the criteria, measures of impact, and thresholds for determining visual and architectural impacts that may require mitigation.

4.11.1 Visually Sensitive Receptors

This section describes the methodology used to assess impacts to VSRs and presents the results of the evaluations. Since no new facilities would be constructed as part of any of the No-Build Alternative scenarios, this area of impact discussion is limited to the Proposed Action.

4.11.1(a) Methods of Analysis

There are three steps in evaluating the impacts of the project on VSRs: identification of the area of potential impact, line of sight analysis, and identification of effect.

Identification of the Area of Potential Impact. This step was completed as part of the inventory presented in Section 3.11.2. It was determined that from each of the VSRs listed in Table 3.11-1 in Appendix B that the

existing view is visually sensitive, and no intervening factors (structures, topography, vegetation) exist which would clearly screen or buffer the electrification project in the view from the VSR.

TABLE 4.11-1 Evaluation Criteria for Visual and Architectural Impacts

IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Project-generated effect on visually sensitive receptors (VSRs)	Existing views of waterfront or scenic area would be permanently impaired or diminished	Visual Modification Classification of 3 or 4
Project-generated effect on architecturally sensitive receptors (ASAs)	New structure would be out of scale in height or mass, or out of character in style or substance from existing neighborhood	None

Source: DMJM\Harris, 1993

Line of Sight Analysis. The purpose of this analysis is to determine whether and how much of the project components would likely be visible from each VSR. Once this was determined, a visual modification classification (VMC) from 1 to 4 was assigned to each VSR, based upon the projected dominance of the project components in the view. The VMC considers both the distance of the project components from the VSR and the existing visual complexity (VC) of the skyline, as described in Section 3.11.2. The four VMC classifications are as follows:

- VMC 1 indicates that the electrification components would not be visible from the VSR unless pointed out.
- VMC 2 indicates that the electrification components would be visible, but would be subordinate to other features within the view from the VSR.
- VMC 3 indicates that the electrification components would be co-dominant with other features in the view from the VSR.
- VMC 4 indicates that the project components would be dominant within the view from the VSR.

Following the evaluation criteria in Table 4.11-1, VMCs 1 and 2 would not impact visual resources, while VMCs 3 and 4 could impact these resources.

In order to determine whether and how much of the project components would likely be visible from each VSR and, thus, the potential visual modification classification for each of the VSRs, the five representative sites depicted in Figures 3.11-1 through 3.11-5 were altered to represent conditions resulting from the No-Build Alternative scenarios and the Proposed Action. As the signal poles and wires clearly visible in Figures 3.11-2 and 3.11-5 will be removed over the next several years as part of a separate project, the view for the 2010 No-Build Alternative is different from the existing views shown in Chapter 3. Each of the projected no-build views from the representative VSRs is shown paired with the projected view with the Proposed Action (see Figures 4.11-1 through 4.11-10).

Based on these projected views, VMCs have been assigned to each of the representations as shown below:

Location	**Distance from Track**	**View**	**VC**	**VMC**
76 Thimble Island Road, Branford, CT	350 ft	L.I. Sound	High	2
211 Seneca Drive, Groton, CT	360 ft	Palmer Cove	Moderate	4
162 Wilcox Road, Stonington, CT	480 ft	L.I. Sound	Low	2
13 Lambert's Lane, Stonington, CT	880 ft	Stonington Harbor	Moderate	1
4490 Boston Post Road, Warwick, RI (Harborwatch Condominiums)	50 ft	Greenwich Bay	Low	4

As shown above, great distance and high visual complexity of the existing skyline generally would contribute to minimal or no impact on the existing view (VMC 1 or 2). Conversely, shorter distances and low visual complexity generally would result in adverse effects (VMC 3 or 4).

As discussed in Chapter 2, portal structures would be installed in areas where the electrification system must span three or more tracks. As indicated in Figures 2.4-4 and 2.4-5, portal structures could be slightly more noticeable than catenary pole pairs due to the horizontal beam. While the visual impact of these structures may be slightly higher than that of the catenary pole pairs, it would not alter the VMC ranking shown in Table 3.11-1.

4.11.2 Impacts

4.11.2(a) Environmental Impacts

The project components that may affect views are primarily the overhead catenary supports and wires. Based on the altered representative views and methodology presented in the previous section, a VMC has been determined for each one of the VSRs listed in Table 3.11-1 in Appendix B. The project may impact 42 of the 66 identified VSRs (those with a VMC of 3 or 4). This is 19 percent of the 225 potential VSRs identified in this study.

The relative significance of these impacts should be judged in the context of the views in recent history. For the last several decades the Amtrak line included a signal pole line with poles 15 to 25 feet tall spaced approximately every 100 feet. From these poles are hung several signal wires. In the view of the future, the signal pole line would be removed and replaced with catenary poles 31 feet high, on both sides of the track, spaced approximately every 200 feet on tangent track and closer on curves with the shortest distance between poles on the sharpest curves being 75 feet. A 12-foot arm will be extended from these poles and from that arm will be hung four wires. To permit a comparison of the relative scale of the proposal catenary system with that of the historic pole line, catenary poles and wires were superimposed on pictures showing the existing pole line in Figures 4.11-11(a) and 4.11-12(a). Since the existing pole line will be removed, Figures 4.11-11(b) and 4.11-12(b) show the same view as it would appear after the project is completed. The poles associated with the Proposed Action would not be significantly more intrusive than existing conditions.

4.11.2(b) Construction Period Impacts

There are no anticipated construction period impacts from the Proposed Action or the No-Build Alternative.

FIGURE 4.11-1. 2010 NO-BUILD ALTERNATIVE VIEW FROM RESIDENCE AT 76 THIMBLE ISLAND ROAD IN STONY CREEK SECTION OF BRANFORD, CT

FIGURE 4.11-2. VIEW WITH PROPOSED ELECTRIFICATION FROM RESIDENCE AT 76 THIMBLE ISLAND ROAD IN STONY CREEK SECTION OF BRANFORD, CT

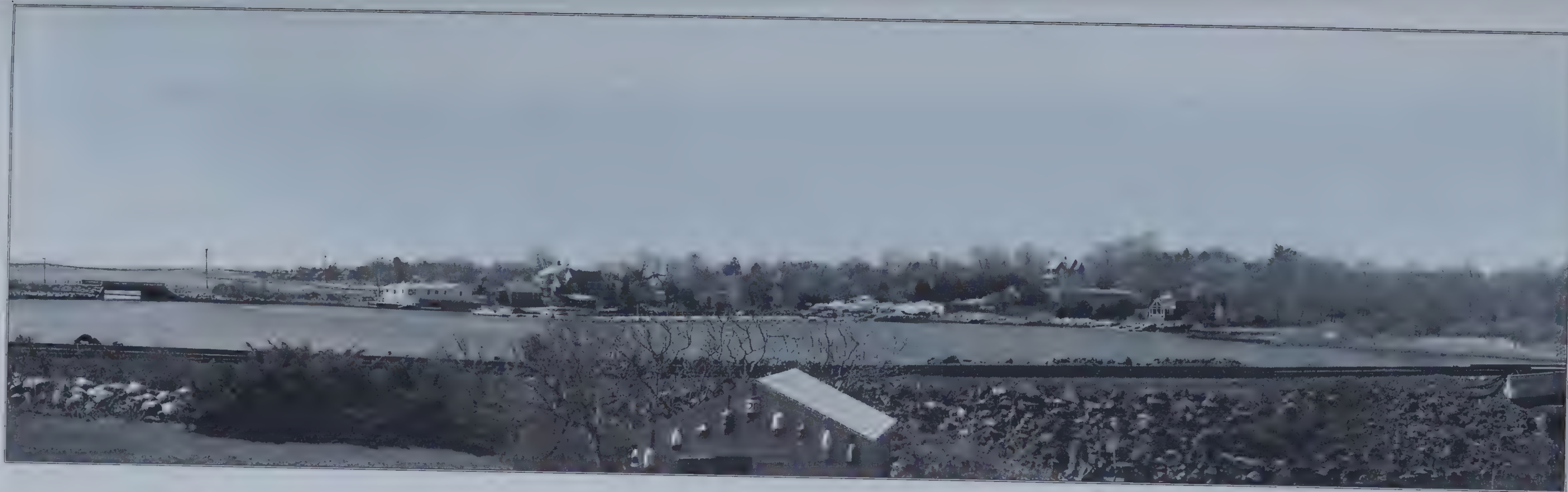


FIGURE 4.11-3. 2010 NO-BUILD ALTERNATIVE VIEW FROM RESIDENCE AT 211 SENECA DRIVE IN NOANK SECTION OF GROTON, CT

FIGURE 4.11-4. VIEW WITH PROPOSED ELECTRIFICATION FROM RESIDENCE AT 211 SENECA DRIVE IN NOANK SECTION OF GROTON, CT

FIGURE 4.11-5. 2010 NO-BUILD ALTERNATIVE VIEW FROM RESIDENCE AT 162 WILCOX ROAD IN STONINGTON, CT

FIGURE 4.11-6. VIEW WITH PROPOSED ELECTRIFICATION FROM RESIDENCE AT 162 WILCOX ROAD IN STONINGTON, CT

FIGURE 4.11-7. 2010 NO-BUILD ALTERNATIVE VIEW FROM RESIDENCE AT 13 LAMBERT'S LANE IN STONINGTON, CT

FIGURE 4.11-8. VIEW WITH PROPOSED ELECTIFICATION FROM RESIDENCE AT 13 LAMBERT'S LANE IN STONINGTON, CT

FIGURE 4.11-9. 2010 NO-BUILD ALTERNATIVE VIEW FROM HABORWATCH CONDOMINIUMS AT 4496 BOSTON POST ROAD IN WARWICK, RI

FIGURE 4.11-10. VIEW WITH PROPOSED ELECTRIFICATION FROM HABORWATCH CONDOMINIUMS AT 4496 BOSTON POST ROAD IN WARWICK, RI

4.11.3 Architecturally Sensitive Areas

4.11.3(a) Environmental Impacts

There are two steps in evaluating the impacts of the Proposed Action on ASAs: identification of the area of potential impact, and assessment of architectural compatibility. The areas of potential impact were identified as part of the inventory presented in Section 3.11.2(b). The only facilities with the potential to impact an ASA would be the Roxbury Crossing Substation and Noank Paralleling Station. The remaining 23 electrification facilities would be sited in undeveloped areas or areas where they would not be incompatible with the existing development (railroad yards, industrial areas). The Roxbury Crossing facility would be sited in an urban area of mixed commercial and residential development and would be potentially out of scale and character with the surrounding development.

The Noank Paralleling Station, which previously would have been located in an area designated as architecturally sensitive, has been relocated to an alternate location. Although the site is secluded and well screened by heavy vegetation, one component of the facility could impact the surrounding area. The electrical component known as the gantry could extend approximately 10 feet above the existing tree line. Unless redesigned, this element would be out of scale and character with the surrounding area and would impact views from surrounding roadways, homes, and recreation areas in this scenic area.

4.11.3(b) Construction Period Impacts

There are no construction period impacts anticipated.

FIGURE 4.11-11(a). COMPARISON OF THE HISTORIC POLE LINE AND THE FUTURE CATENARY SYSTEM LOOKING EASTBOUND AT FREEMAN'S CROSSING, STONINGTON, CT

FIGURE 4.11-11(b). VIEW WITH PROPOSED ELECTRIFICATION LOOKING EASTBOUND AT FREEMAN'S CROSSING, STONINGTON, CT

FIGURE 4.11-12(a). COMPARISON OF THE HISTORIC POLE LINE AND THE FUTURE CATENARY SYSTEM LOOKING SOUTH AT FREEMAN'S CROSSING, STONINGTON, CT

FIGURE 4.11-12(b). VIEW WITH PROPOSED ELECTRIFICATION LOOKING SOUTH AT FREEMAN'S CROSSING, STONINGTON, CT

4.12 NATURAL RESOURCES

This section summarizes the anticipated effects of the Proposed Action upon the natural environment within the NEC study area. The No-Build Alternative scenarios do not involve construction of electrification facilities, modification of bridges, or installation of catenary, and thus are not expected to impact on the natural resources in the study area. The focus of this analysis is the construction and operation of the proposed 25 electrification facilities, the construction activities associated with seven bridge modifications, and installation of the catenary at the five moveable bridges. This section includes an assessment of the projected stormwater runoff from the project and its potential effects on surface water resources, as well as a discussion of the existing drainage situation in the portion of the NEC in Boston between the Arlington/Tremont Street overhead bridge and South Station. The criteria used to evaluate the project impacts on natural resources are summarized in Table 4.12-1.

4.12.1 Methods of Analysis

4.12.1(a) Wetlands

Two types of wetlands impacts were considered in this analysis. Direct impacts on wetlands are identified by the encroachment into an area identified as wetlands according to Federal and state regulations, as described in Section 3.12. Any activity, including dredging, filling, or any alteration of a wetland would be considered to have a direct impact. Potential indirect impacts on wetlands include siltation and sedimentation, as well as runoff of contaminants. Potential indirect impacts on wetlands are identified by the location of an activity in the state-regulated setback area from a designated wetland. The setback distance in Massachusetts is 100 feet and in Rhode Island the distance is 50 feet. In Connecticut, local jurisdictions regulate inland wetlands and designate the setback distance which varies from locality to locality, while ConnDEP regulates coastal wetlands and does not identify a setback distance. For the purposes of this analysis, a 100-foot setback distance is utilized to identify potential indirect impact to wetlands in Connecticut.

4.12.1(b) Critical Wildlife Habitat

For the purpose of this evaluation, any activity, including the construction of facilities, that would result in degradation to wildlife habitat considered to be of high value, will be considered a potential impact on critical habitat.

4.12.1(c) Endangered Species

Any activity located in the habitat of a Federal or state-listed threatened or endangered species may affect the species. Project components proposed for such locations are identified as having a potential impact on the species; additional consultations with appropriate agencies have been undertaken to identify whether such impacts to endangered species would be likely.

4.12.1(d) Floodplains

Any construction of facilities proposed within the boundary of the 100-year floodplain will be considered a potential impact to the flood storage capacity.

4.12.1(e) Coastal Resources

Any construction that would significantly alter the shoreline configuration, particularly in high velocity flood zones, would be considered an adverse impact.

4.12.1(f) Water Resources

Two types of sensitive water resources may be affected by the Proposed Action: groundwater and surface water. Groundwater includes sole source aquifers, locally protected water resource or recharge protection areas, and water supply wells. Groundwater is susceptible to contamination, particularly from accidental spills or releases of contaminants, normal leakage from construction equipment or trucks, and stormwater runoff.

TABLE 4.12-1 Evaluation Criteria for Impacts to Natural Resources

RESOURCE	IMPACT CRITERIA	MEASURE	SIGNIFICANCE THRESHOLD
Wetlands	Alteration[1] or destruction of wetland or resource area[2] including dredge or fill.	Volume or area of wetland or resource area altered or destroyed by the project; change in flow of water into or from a wetland, quantification of any changes in salinity levels of water in the wetland.	Violation of Federal or state limitations.
	Effect of project on functional value[1] of wetlands or resource area.[2]	Potential for altering character of wetland; project-generated change in functional value of wetland.	Any alteration or adverse impact on functions or areas subject to protection.
Critical Wildlife Habitat	Effect of project on wildlife habitat (including wetlands), resources, migration, and critical life stages (breeding, nesting, spawning, and migration).	Amount, functional value, and regional scarcity of wildlife habitat; project-generated change of carrying capacity of wildlife habitat; project activity during critical life stages.	Predicted long-term displacement of wildlife or blockage of migratory routes. Predicted long-term change in habitat incompatible with the existence of wildlife.
	Effect of project on habitat or local population of threatened or endangered species and species of general concern.	Project-generated change in carrying capacity of habitat; project activity during critical life stages.	Any predicted change in habitat or blockage of migratory routes. Any action that jeopardizes threatened and endangered species or species of special concern.
Floodplains	Effect on human health and safety and property downstream.	Project-generated change in flood storage volume.	Net reduction in flood-storage capacity.
	Effect on natural beneficial values of floodplain.	Same as above.	Same as above.
Coastal Resources	Effect of project on natural resources, as well as visual and recreational opportunities in coastal areas, including but not limited to wetlands, coastal features, floodplains, and fish and wildlife.	Consistency with applicable state Coastal Zone Management Acts, under Federal Consistency Programs.	Violation of Federal or State Limitations.
Water Resources	Stormwater runoff effects during and after construction.	Amount, duration and extent of project-generated increase in runoff and contaminant or sediment transport.	Potential for violation of Federal or state water quality criteria and standards; sedimentation of wetlands or surface water; dilution of coastal waters.
Special Protected Areas	Effect of project on Special Protected Areas.	Change in qualities or characteristics that make area eligible for special protection.	None

Notes: [1,2]As defined in Federal and state regulations.

Source: Smart Assoc., 1994

Surface waters, which include rivers, streams, lakes, ponds, bays, oceans, and wetlands, are susceptible to contamination, as described above, as well as to siltation and sedimentation, particularly during construction. To address long-term impacts to surface water resources, a drainage analysis was performed at all proposed electrification facilities sites. Stormwater runoff rates were calculated for the 10-, 25-, and 100-year storm events using storm intensity curves provided by the National Weather Bureau. Sites adjacent to wetlands or surface water resources were then examined for potential impacts.

For the purpose of the study, any construction (including bridge modifications) over or within the immediate vicinity of locally protected groundwater supplies or recharge areas, sole source aquifers (designated by the U.S. EPA), or water supply wells will be considered to have the potential for affecting such resources. Any facilities sited within the buffer zones (as described in Section 4.12.1(a) for wetlands) of surface water supplies will be considered to have the potential for affecting such resources.

4.12.1(g) Special Protected Area

Any activity that would change the qualities or characteristics that make an area eligible for special protection would be considered a potential impact to Special Protected Areas.

4.12.2 Impacts

4.12.2(a) Environmental Impacts

Wetlands.

Proposed Action: There should be no direct impacts on wetlands as a result of the Proposed Action. Amtrak's proposed site plan for the Leetes Island Paralleling Station involves a small intrusion (less than 100 square feet) by the access road into a wetland. As provided in Chapter 5, this access road will be shifted to avoid the wetland. To accommodate possible future construction of a third track by the State of Rhode Island, Amtrak initially planned to use portal structures to support the catenary. In three locations totaling less than 100 square feet, a portal support would be installed in wetlands. As provided for in Chapter 5, Amtrak will explore the use of an alternative catenary support in this area that would eliminate the need to use wetlands.

The Old Lyme and State Line parallelling station sites are identified on state and local soil maps as hydric soils, which would be classified as wetlands. Field inspections of these sites, however, indicate that these particular locations are not wetlands. (See Chapter 8, Appendix A, in Volume II of the FEIS/R for documentation.)

Potential long-term indirect impacts on wetlands include stormwater runoff from the adjacent facility sites and possible contamination from the release of mineral oil from the transformers. The Proposed Action could result in indirect impacts to wetlands at 10 of the 25 electrification facility sites:

- Branford Substation
- Leetes Island Paralleling Station
- Madison Paralleling Station
- Grove Beach Paralleling Station
- Old Lyme Paralleling Station
- Noank Paralleling Station
- Canton Paralleling Station
- Bradford Paralleling Station
- Richmond Switching Station
- Norton Switching Station

These impacts can be largely avoided through the use of the Best Management Practices and good design as presented in Chapter 5. As a consequence, no significant impacts to wetlands are anticipated.

Existing Rail Bridge/Embankment System: Several commenters on the DEIS/R expressed concern that the existing Amtrak railbed and bridges are constricting tidal flows into wetlands and coves along the Connecticut coast,

adversely affecting these wetlands areas. At the request of the ConnDEP, the U.S. Army Corps of Engineers, under the auspices of Coastal America, studied this issue. Recently completed, the study[43] investigated eight coastal wetlands and marshes, and incorporated the results from DEP-sponsored restoration studies of two additional wetlands.

The study determined that no significant environmental changes had occurred which could be attributed to the rail bridge/embankment system; thus, replacing bridges with a longer span or installing culverts in the embankments would not change existing conditions. In fact, the study noted that increasing the cross-sectional area of the inlet could reduce current velocities which would promote increased deposition of sand, further impeding navigation.

From the Corps study two significant conclusions were reached: First, only a few embayments among those studied were identified as supporting degraded wetlands upstream of bridges. Thus, bridges are not a primary cause of salt marsh degradation. Second, for those sites where the transportation facility was a bridge/embankment complex, the study concluded that bridges are not causing measurable or significant tidal flow reductions and are not the cause of salt marsh degradation.

Critical Wildlife Habitat. The Kingston paralleling station is proposed to be located on an upland site within the Great Swamp Wildlife Management Area, which has a high wildlife value. The paralleling station itself, however, would be located on the boundary of the reservation between the railbed and an access road. There is an osprey nesting site near this proposed facility. No long-term impacts on ospreys are anticipated. Studies conducted for FRA have shown that they are relatively insensitive to rail passenger operations.[44]

The five moveable bridge sites are considered to be in critical finfish habitat, due to the presence of anadromous species. The Connecticut River is a critical habitat due to the presence of the Federally listed species, Shortnose sturgeon. Consultation with the U.S. Fish and Wildlife Service, the National Marine Fisheries Service (NMFS), and the appropriate divisions of ConnDEP has been undertaken, and FRA and these agencies have concluded that long-term impacts would be minimal.

Endangered Species. One Federally listed endangered species, the Shortnose sturgeon, migrates into the Connecticut River in the area of the moveable bridge. Based on review of available literature and interviews with recognized authorities[45] on Shortnose sturgeon in the Connecticut River, there would be no long-term impacts to spawning or feeding grounds or on fish migration.

A state-listed endangered species, the American bittern, has been recorded within close proximity to the proposed Stonington Paralleling Station site. Consultation with the Connecticut Natural Diversity Database and the Connecticut Valley Wildlife Division of DEP was undertaken to ascertain the presence of this species. The species was not located during a field visit, however, the best available habitat in the vicinity of the proposed site would appear to be over 200 feet to the south of the tracks and over 200 feet to the southeast of the paralleling station site. Due to its distance, the long-term operation of the project would not be expected to interfere with activities of this rare species. The distance combined with a dense vegetated cover type would be expected to buffer any noise impacts.

Four Massachusetts-listed endangered species, the Spotted and Blandings turtles, the Least bittern, and the Elderberry longhorn beetle, have been identified in the Fowl Meadow ACEC. Although no electrification facilities would be located in this area, the catenary would be installed though the ACEC. After consultation with the Massachusetts Natural Heritage Program and the Massachusetts DEP it was concluded that no impact is expected on these species because the work would be conducted within the existing ROW.

Floodplains. Three of the electrification facilities and one bridge modification would be located within the 100-year flood boundary: the Leetes Island and Stonington paralleling stations, the New London Substation and the Maskwonicut Street Bridge. Installation of the facility sites should have a minor effect on flood storage capacity

and would not require creation of compensatory storage. Based on current plans, no encroachment of the floodplain, which is approximately 60 feet west of the rail line, would occur for Maskwonicut Street Bridge.

Coastal Resources. While portions of the NEC fall into the coastal zone in all three states, only in Connecticut are project facilities and bridges located in the coastal zone. As stated in the Connecticut Coastal Zone Management Act (Section 3.1), new structures must be designed, constructed, and maintained to minimize adverse impacts on coastal resources, circulation and sedimentation patterns, water quality, and flooding and erosion, among other things. The proposed facilities and existing bridge located within the Connecticut coastal zone include:

- New London Substation site
- Millstone Road West Bridge
- Leetes Island Paralleling Station
- Grove Beach Paralleling Station
- Old Lyme Paralleling Station
- Millstone Paralleling Station
- Noank Paralleling Station
- Stonington Paralleling Station
- State Line Paralleling Station

Of these facilities, one is within a coastal flood hazard area and could have an impact on coastal resources. The Leetes Island Paralleling Station would displace approximately 600 cubic yards of flood storage capacity. However, the relative magnitude of this impact would be minimal due to limited downstream development. In accordance with the Coastal Zone Management Act, alternative sites were analyzed, but for locational and access reasons, this site is the preferred location. The remaining eight sites are in shorelands and should not have an impact. Therefore all sites within the coastal zone should also be consistent with the Act. However, a coastal consistency determination will not be issued until detailed application plans associated with the permit process are reviewed by the State of Connecticut.

In addition to the Proposed Action facilities listed above, all five of the moveable bridges are located in the coastal flood hazard area and could have a direct impact on finfish spawning and migration patterns. However these potential impacts would be largely avoided by the mitigation measures, shown in Section 5.1.1 (see Section 4.12.2(b).

Water Resources. The proposed facility sites could affect both groundwater and surface water resources. The project would not, however, affect the existing track drainage system along the railroad ROW. Consequently, no changes in the quantity of stormwater flow from the track bed are anticipated.

Groundwater Resources: Groundwater supplies include sole source aquifers, locally designated groundwater and recharge protection districts, and water supply wells. Project facilities that would be sited over the aquifers or groundwater/recharge protection areas, or in the immediate vicinity of water supply wells, are considered to have the potential for affecting such resources. The following facilities could impact groundwater supplies:

- Branford Substation
- State Line Paralleling Station
- Bradford Paralleling Station
- Richmond Switching Station
- Kingston Paralleling Station
- Exeter Paralleling Station
- East Greenwich Paralleling Station

Potential impacts to groundwater would include contamination that would reach the water resource through the soil, particularly from accidental spills or releases of contaminants during operation; normal leakage from

equipment or trucks; and stormwater runoff. The potential for such impacts, however, is reduced, if not eliminated, by the use of Best Management Practices and other mitigation measures incorporated as part of the project in Chapter 5.

Project MUD. The MBTA has expressed a special concern relative to Amtrak proposals to lower the present track profile under bridge structures between Back Bay Station and South Station in Boston. During the decade of the 1980s, the MBTA managed the construction of the Southwest Corridor Project (SWCP) which involved reconstruction of the Northeast Corridor Route from a point east of Back Bay Station to a point west of Forest Hills (approximately 4.7 miles). This project involved placement of three high-speed railroad tracks in a depressed alignment to replace the previous ground-level and embankment line segment. For most of the length of this project, a "U" shape, reinforced concrete structure, supported by prestressed 100-foot-long concrete piles, was installed. This structural configuration is commonly called a boat section.

Concurrent with construction of the SWCP, FRA determined to improve the track structure between the east end of the SWCP and South Station as part of NECIP. This track segment improvement activity became known as Project MUD. For this segment, a membrane was placed upon the subbase, and then rock ballast and the track assembly installed over the membrane. Both the SWCP and Project MUD were designed so as to avoid adverse changes to the drainage patterns and the water table level within the two project areas.

Despite the drainage work constructed as part of SWCP and Project MUD, and inspections verifying that the drainage improvements are functioning as designed, changes in the water table in the Back Bay area apparently continue. The cause of such changes is unclear. The MBTA is concerned that activities to add additional clearance under bridges in the Project MUD area could adversely impact the groundwater levels in the vicinity.

Amtrak proposes to lower the three tracks at the Arlington/Tremont Streets overhead bridge (MP 228.13) and at the Albany/Broadway overhead bridge (MP 228. 51) within the Project MUD area to provide adequate clearance for the catenary. To accomplish this, Amtrak would remove a maximum of 5 inches of ballast in an area where the current depth of ballast under the ties ranges between 14 and 33 inches. The catenary would be hung either from bridges or from arms attached to existing concrete walls. Amtrak's proposal for increasing clearances and installing the catenary in the Project MUD area would not affect, either positively or negatively, the drainage system in this area or groundwater levels.

Adjusting the depth of ballast section should not have any impact on the groundwater levels. A ballast section is designed to allow for maximum drainage, and groundwater levels do not regularly extend into the ballast section. Amtrak also would use construction techniques to avoid damaging the membrane. Amtrak does not plan to use the undercutters in this area; instead it would use front end loaders and similar construction equipment. (In a previous inspection of the membrane, all of the ballast was removed using the same procedures, with no damage to the membrane.)

The installation of catenary also should not have any impact on the groundwater levels, since no poles would be used in the Project MUD area. By eliminating the need for catenary poles and their foundations in this area, the membrane or adjacent ballast would not be disturbed.

Notwithstanding the lack of impact from the Proposed Action on Project MUD and related issues, FRA has expressed its willingness to work with the MBTA in the context of NECIP to identify whether and how rail improvements may be affecting the water tables and in developing the appropriate response.

Surface Water Resources: Three of the 25 proposed facility sites are located within the buffer zone of surface waters and could have a potential impact:

- Branford Substation
- Exeter Paralleling Station
- Attleboro Paralleling Station

The potential for such impact, however, is minimized because of the incorporation of Best Management Practices and other mitigation measures into the Proposed Action as discussed in Chapter 5. Long-term impacts to surface water are not anticipated from the installation of submarine cables at moveable bridges.

Special Areas of Concern. Three of the 25 proposed facility sites are located within special areas of concern and could have a potential direct impact:

- Kingston Paralleling Station
- East Foxboro Paralleling Station
- Readville Paralleling Station

The Kingston site is located within the Great Swamp Wildlife Management Area in South Kingstown, RI. Although the design and location of the site was selected to avoid and minimize impacts, FRA has determined the placement of the station constitutes a "use" under Section 4(f) of the Department of Transportation Act of 1966 (49 USC 303(c)). A Section 4(f) evaluation for this site has been prepared and is included in Appendix G of this FEIS/R. This evaluation assessed the effects of the paralleling station and explored whether prudent or feasible alternative locations existed. No prudent or feasible alternative locations have been found; therefore, mitigation in the form of providing additional parkland and other measures incorporated into the Proposed Action has been selected.

The East Foxboro site is located within the Canoe River ACEC. Any facility located within an ACEC is considered to have an adverse impact. Because of the small size of the facility, the close proximity to the rail line, the small amount of destroyed habitat, and the use of an existing access road, the overall impact of the site is considered to be minor.

The Readville site is located within the Fowl Meadow ACEC. The site is bordered by railroad tracks to the north and south and access is from an existing road. Although the site is within an ACEC and is designated as having an impact, the overall impact is considered to be insignificant because of the surrounding land use.

4.12.2(b) Construction Period Impacts

Wetlands. There would be no direct filling or disturbance of wetlands from the Proposed Action, except for Leetes Island where the access road could require the taking of a small portion of the wetland. Mitigation proposed as part of this project attempts to avoid direct impacts to this wetland. Potential indirect impacts from construction of the electrification facilities (and their access roads) and the raising of bridges could include siltation and sedimentation as well as runoff from contaminants and changes in salinity levels. The sites discussed in Section 4.12.2(a) could have an indirect impact to wetlands from construction activities. However, these impacts can be mitigated and the net impact is considered minimal.

Critical Wildlife Habitat. The Kingston Paralleling Station and associated catenary pole installation are proposed to be sited within the Great Swamp Wildlife Management Area, at the edge of a forested habitat, and near an area of critical osprey nesting habitat. Construction in the vicinity of osprey nests has the potential to impact this species during the breeding season. Chapter 5 provides that construction near osprey nests will not take place between March 15 and August 15. As a consequence there should be no impact on osprey as a result of construction of this facility. Amtrak will also cooperate with RIDEM to establish additional osprey nesting poles.

The five moveable bridge sites are located within critical finfish habitats. During the construction activity of burying electrical cable under the bridges important characteristics of the marine habitat could be directly affected. Temporary impacts, including turbidity and disturbance of marine sediments, could affect marine estuarine and anadromous fish (fish that swim from the sea to fresh water for breeding purposes), especially during migration and spawning seasons. Indirect construction impacts could occur to adjacent habitat from situations at each of the bridge locations. Work at each of the sites is expected to last for 10 days. Both the direct and indirect impacts are considered short-term due to the length of construction at each bridge.

In each of the five bridge crossings a variety of species occur which could be adversely impacted by the project. A list of Species of Concern was provided by ConnDEP, Fisheries Division. ConnDEP applies seasonal restrictions:

• Winter flounder	February 1 through May 30
• Anadromous fish runs	April 1 through June 30
• Shortnose sturgeon (a Federal listed species)	April 1 through August 15
• Shellfish	June 1 through September 30

The state of Connecticut restricts work in the Connecticut River between April 1 and September 30. Marine construction would be thereby limited to October 1 through January 31, thereby minimizing the potential adverse impacts on these species.

Endangered Species. The Shortnose sturgeon, mentioned above, is a Federally listed endangered species which migrates into the Connecticut River in the area of the moveable bridge. The site apparently is used primarily as a feeding ground during the low salinity period between April and mid-June. Construction activity could have a direct adverse impact on the Shortnose sturgeon, however, Amtrak will schedule construction outside of the restricted work period in the Connecticut River between April 1 and September 30. Thus, there should be no construction impact to the Shortnose sturgeon.

The American bittern, a Connecticut-listed species, has been recorded within close proximity to the Stonington Paralleling Station site. Construction activity of the facility could have a direct impact to its nesting season between May 1 and August 15. However, Amtrak will construct the site outside of the nesting season. Thus, there should be no impact during construction to the American bittern.

Floodplains. No construction period impacts are anticipated.

Coastal Resources. Construction period impacts are the same as those identified in critical wildlife habitat and endangered species.

Water Resources.
Groundwater Resources: Three Sole Source Aquifer Areas are located in the corridor: Pawcatuck and Hunt-Anaquatucket-Pettaquamscutt in Rhode Island, and Canoe River in Massachusetts. Construction in a Sole Source Aquifer area has the potential to impact the resource, primarily through contamination from construction equipment operation. A direct impact to water quality during installation of catenary poles is also possible due to sedimentation and erosion. This potential impact would be short-term and would be mitigated by incorporation of Best Management Practices.

Surface Water Resources: The Branford substation, the Exeter and Attleboro Paralleling Stations, and the Maskwonicut Street Bridge are located within the buffer zones of surface waters, or are considered to be close enough to be cause impacts. The principal potential short-term direct impacts from construction activities would be erosion and sedimentation and accidental spills or releases of contaminants during construction of the facility. Installation of submarine cables at the five moveable bridges could also create surface water impacts during

construction: disturbance of bottom sediments, potential re-introduction of contaminated sediments to the water column, and potential erosion and sedimentation as a result of on-shore activities.

Special Areas of Concern. No construction period impacts are anticipated.

4.13 HAZARDOUS MATERIAL AND SOLID WASTE

This section evaluates the potential for the disturbance of special and hazardous waste from the operation and construction of the Proposed Action.

4.13.1 Methods of Analysis

The characteristics that distinguish hazardous wastes from nonhazardous wastes include ignitability, corrosivity, reactivity, and toxicity. Any waste that exhibits one or more of the four characteristics is considered a hazardous waste and must be handled, stored, treated, transported, and disposed of in accordance with appropriate Federal and state regulations.

The following sections outline the methods used to assess the potential for hazardous waste to be generated either during operation of the Proposed Action, or encountered during construction of the electrification system.

4.13.1(a) Analysis of Electrification Operation

Operations at Electrification Facility Sites. There was concern that the operation of the electrification facilities could result in the release of hazardous materials to the environment, particularly sensitive areas such as sole source aquifer areas or wetlands. Electrification facility designs were reviewed to determine whether potentially hazardous material could be released into the environment. There are no diesel generators proposed at any of the facility sites, consequently, there would not be any fuel storage tanks. Transformers used at these facilities would contain mineral oil, with quantities ranging from 40,000 liters at substations to 4,000 liters at paralleling stations. The mineral oil would conform to ASTM specification D 3487 and would not contain detectable levels of PCBs.

Application of Herbicides. The Proposed Action would not change the currently existing use of herbicides as part of ROW maintenance. In order to control the emergence of vegetation along the ROW herbicides are dispensed as part of routine railroad maintenance. The application of herbicides is governed in Massachusetts under the Wetlands Protection Act (M.G.L. c. 131 ss. 40), Right of Management Regulations (333 CMR 11.00 et sec). Therefore, Amtrak must prepare a Yearly Operational Plan as well as a 5-year Vegetation Management Plan. These plans include identification of herbicide products to be utilized, terms and methods of application, and the location of sensitive areas such as wetlands. In Massachusetts the wetlands along the ROW must be delineated and the delineations approved by each affected Conservation Commission.

4.13.1(b) Analysis of Construction of Facility Sites and at Bridges

Of the 25 substations and switching and paralleling stations, seven are located on Amtrak property and three are located on MBTA property; the remainder are sited on public or private property to be acquired by Amtrak. Excavation of soil for grading and foundations could disturb contaminated materials on-site. The following sections describe the methods used for estimating the potential for chemical contamination.

Amtrak/MBTA-Owned Property. The 10 proposed sites currently owned by Amtrak or the MBTA were assessed based on whether they were located along the ROW or in a station or rail yard. Sites along the ROW could contain chemical contamination typically associated with diesel locomotive systems such as diesel fuel and grease, but are less likely to be contaminated than sites within rail yards or stations where trains are more likely to sit idle.

Properties not owned by Amtrak. Properties to be acquired by Amtrak were assessed to determine whether significant levels of contamination might be present. The assessment consisted of file searches of environmental databases and limited subsurface testing. Those sites that indicated significant levels of contamination would be relocated in order to minimize removal and disposal impacts.

For the 15 sites Amtrak proposes to acquire, ownership histories and database searches provided by Amtrak (property deeds) were examined to determine whether the properties had the potential to contain chemical contamination which could be disturbed during facility construction. The ownership history was evaluated to determine whether former land use activities on the site (e.g., chemical or manufacturing companies) may have involved a release of hazardous waste. Amtrak also conducted a search of several databases to determine whether any of the potential property sites had a history of contamination or had been reported for a release of hazardous materials into the environment. This search included a review of eight Federal and state environmental databases, including Federal and state Superfund sites, state hazardous waste sites and underground storage tank sites.

Of the properties searched, only the Elmwood Paralleling Station site was listed in one of the databases. In October 1993 and February 1994, soil sampling was performed at all sites except Noank, which was being relocated due to land use and visual impacts raised in the DEIS/R. The sampling program tested for total petroleum hydrocarbon (TPH), and Resource Conservation and Recovery Act (RCRA) - 8 metals.

Bridge Modifications. Lead is typically found on most steel bridges due to the favorable performance characteristics of lead-based paint and the widespread use of this paint until the 1960s. It is likely that during bridge raising/replacement lead-bearing dust could be generated and would require containment. Bridges constructed of concrete or timber are not likely to be painted; however, appropriate identification of lead-based substances will be conducted prior to the commencement of construction.

Undercutting Sites. In order to accomplish necessary clearances without modifying overhead structures, some track sections would have to be lowered in a process known as undercutting. Undercutting involves removing a layer of soil and ballast beneath the tracks in order to lower their elevation. Undercutting would occur at 32 locations along the corridor, displacing approximately 76,000 cubic yards of material. There is a potential that, due to the past use of the ROW and the age of the corridor, excavation work would encounter at least minimal levels of contaminated materials. To identify and characterize possible contamination, 105 soil samples were taken at the 32 bridge locations representing 22 miles of track undercutting. Soil sampling tested for volatile organic compounds (VOC), polychlorinated biphenyls (PCB), TPH, and RCRA - 8 metals.

Catenary Pole Installation. Precast concrete foundations would be required for the installation of each catenary pole along the NEC. Approximately 1.5 cubic yards of material would be displaced for each foundation, totaling about 19,500 cubic yards of projectwide. With the exception of areas where portal structures would be placed, the majority of foundations would be located within the existing ROW. Soil conditions encountered at the catenary pole installation sites are consistent with those identified for undercutting.

4.13.2 Impacts

4.13.2(a) Environmental Impacts

Operation of Electrification Facilities. The operation of an electrified Northeast Corridor including its ancillary facilities should not generate hazardous waste. Should there be a failure of a transformer at a facility there could be a release of mineral oil. However, the design of the electrification facilities incorporates concrete retention reservoirs to be constructed on-site.

In the event there is a loss of oil in the transformer, the control unit will sense the drop in oil pressure and trigger a low-pressure alarm, which would be observed at Amtrak's communications center. As the mineral oil is not hazardous, and as the concrete pit would retain the oil until it was pumped out, there are no significant impacts anticipated to surrounding resources.

4.13.2(b) Construction Period Impacts

Electrification Facility Sites. The results of the file search and subsurface soil sampling indicate that the sites to be acquired by Amtrak are not significantly contaminated. For properties owned by Amtrak and the MBTA, there is a slight potential for contamination. These sites include: Leetes Island, Madison, Old Lyme, Millstone, Bradford, Providence, Canton, Readville, and Roxbury Crossing. Prior to disposal of construction material from these sites, a sampling program would be developed to assess compliance with all appropriate Federal and state regulations.

Bridge Modifications. Of the seven overhead roadway bridges Amtrak proposes to raise or replace, only one, Park Avenue, is constructed of steel and likely to contain some concentration of lead in the paint. Disposal of lead in concentrations above 5 parts per million (0.0005 percent) is regulated by Federal and state agencies. Amtrak's compliance with these regulations would minimize any potential adverse impact.

Undercutting Sites. The results of Amtrak's screening and laboratory sampling program did not detect VOCs. PCBs were found in concentrations ranging between 0.5 parts per million (86 samples) to 15.0 ppm (3 samples), which were well below action levels for the three states. TPH concentrations were detected at concentrations exceeding 50 parts per million (ppm) in 93 percent of the samples and at concentrations exceeding 250 ppm in the remaining samples. Laboratory confirmation on 20 percent of the samples yielded TPH concentrations between 42 and 1,920 ppm with an average concentration of 431 ppm. Massachusetts has a reportable concentration of 500 ppm of TPH for certain soil classifications and a further requirement to identify compounds contributing to TPH. Although Connecticut and Rhode Island do not have specific TPH concentrations which classify material as regulated or hazardous, nevertheless, Amtrak would be required as part of the mitigation measures incorporated into this project to dispose of all undercutting spoils in an appropriate manner, consistent with Federal and Massachusetts regulations.

The concentrations of RCRA - 8 metals in the samples varied widely from location to location with most of the samples containing barium, cadmium, chromium, lead, and arsenic. Again, Massachusetts is the only state with criteria for allowable contaminant concentrations in soil. The RCRA - 8 metals concentrations in the soils sampled did not exceed the specified limits. Although Connecticut and Rhode Island do not have specific regulations regarding RCRA - 8 metals, the states use a Toxicity Characteristic Leaching Procedure (TCLP) test to determine whether the soils are contaminated. Based on an evaluation using conservative assumptions, some of the sites may potentially contain soils which would be regulated as hazardous materials. Analysis of soil by the TCLP method would need to be conducted to confirm this assumption.

Catenary Pole Installation. Since foundation drilling for catenary poles will also extract material directly from the ROW, it may have the potential for contamination. Therefore, prior to disposal an appropriate sampling program would be developed to assess compliance with all appropriate Federal and state regulations.

ENDNOTES

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CHAPTER 5
MITIGATION AND PERMIT REQUIREMENTS

This chapter identifies measures to minimize and mitigate the adverse impacts of the Proposed Action. It also includes a summary discussion of the short-term use of the environment versus long-term productivity of the alternatives considered in the FEIS/R; a discussion of the irreversible and irretrievable commitment of resources associated with these alternatives; and an identification of Federal and state environmental permits needed to implement the preferred alternative.

5.1 MITIGATION OF ADVERSE IMPACTS OF THE PROPOSED ACTION

The Proposed Action offers the best approach to fulfilling the statutory and program goals of the Northeast Corridor Improvement Project. The extension of electric traction as proposed, however, had the potential to adversely impact the environment in a number areas of concern. FRA is requiring Amtrak to include the following measures in the project plans to minimize and mitigate these impacts to the extent practicable. The Proposed Action, as modified by the following measures, is FRA's preferred alternative.

The measures identified below are for the purpose of reducing adverse impacts. If, during the final design and construction of the project, Amtrak identifies alternative measures that are more efficient at addressing the same impacts or concerns and provide an equivalent level of mitigation, FRA will consider a substitution for the measures outlined below.

There are a number of areas of high-speed rail safety where FRA has initiated or soon will initiate regulatory proceedings under the Federal Railroad Safety Act of 1970 (recodified at 49 U.S.C. 20101 et seq.) The mitigation measures identified below are viewed as the minimum applicable to this specific case and they are not intended to "grandfather" this project. To the extent that FRA issues regulations in the future that are applicable to this project, such regulations will be viewed as additive to the measures outlined in this section.

Due to the large geographic area of the project corridor (156 miles) and the multitude of components that comprise the rail corridor (facilities, bridges, grade crossings, and railroad stations), the following discussion has been divided into two parts -- corridorwide and site-specific. The corridorwide mitigation consists of general measures to be incorporated generally throughout the project. The site-specific measures apply to specific sites.

5.1.1 Corridorwide Mitigation Requirements

5.1.1(a) Land Use
No measures are required.

5.1.1(b) Socioeconomic
Effects of New Developments along the NEC. A major part of the State of Rhode Island's plan to develop the Quonset Point complex is improved rail access to the site. In accordance with the trend in the freight rail industry, the RI Department of Transportation (RIDOT) seeks freight rail access capable of handling double-stack container cars requiring a vertical clearance of over 20 feet. RIDOT is presently analyzing alternative approaches to providing rail access meeting these clearance needs. This is the topic of a separate EIS being prepared by RIDOT, the Federal Highway Administration, and FRA. The option receiving the most attention is construction of a third track in the NEC ROW between Boston Switch near Central Falls, RI (MP 190.4), and Davisville in North Kingston (MP 168.0), a distance of 22.4 miles.

Concerns have been raised that certain aspects of the Proposed Action, most notably the placement of catenary poles, might limit the range of alternatives available to the state. To address this potential impact, Amtrak will design and construct the proposed electrification project to accommodate possible future construction of a parallel third track by the State of Rhode Island.

In line with this general requirement, between MP 168.0 and MP 190.4, Amtrak will place the catenary supports in such a manner as to not obstruct possible future construction of a third track on the north side of the existing two-track main line. Any track work in this area will take into account the possible lower profile of the third track under consideration by others. Presently, Amtrak plans to use portal structures in this area and the possible impact of such structures is considered in Sections 4.2 and 4.11 of the FEIS/R. The feasibility of structures with less impact (double cantilevered catenary poles) is presently being evaluated by Amtrak.

Amtrak would not begin construction activities associated with raising overhead bridges in this area for a period of 18 months from the release of this FEIS/R to afford the State of Rhode Island and/or the Providence and Worcester Railroad an opportunity to determine whether either or both wish to contribute to funding an increase in the clearance under such bridges over that required for maintaining existing clearances under the catenary.

5.1.1(c) Historic Resources

A memorandum of agreement (MOA) for each affected state has been developed by FRA in consultation with the state SHPO, the Advisory Council on Historic Preservation, and Amtrak. These agreements, which are included in Appendix D of this volume, stipulate the measures that would be carried out to mitigate adverse effects on historic resources impacted by the Proposed Action.

5.1.1(d) Noise and Vibration

The Proposed Action has the potential to impact the project in three areas: construction, operation of facilities, and train operations.

Noise from Construction. The period of time necessary to erect the catenary system and to undercut the track at bridges is short, averaging 1 to 4 days. Because of the short duration, no significant impacts are expected to result. A larger potential for impact would come from construction of fixed facilities and reconstruction of bridges, because of the longer period of time involved. Table 4.4-5 indicates the areas in which residences would be affected by noise during construction of the electrification facilities or construction on the roadway bridges. Construction noise at these sites would occur intermittently and would be of limited duration, ranging from 1 to 4.5 months for the bridge modifications, and from 2 to 4 months for the electrification facilities. Such noise would normally occur only during weekdays and during daylight hours, and would be intermittent and for limited duration. However, construction noise could exceed the impact thresholds at three of the 25 facility sites and three of the seven bridge modifications. The number of impacted residences totals 28.

Amtrak will mitigate construction noise impacts by including specific noise control requirements in construction contract specifications. The specifications will require contractors to: (1) select the equipment and techniques that generate the lowest noise levels, (2) use equipment with effective mufflers, (3) certify compliance with noise monitoring, and (4) select haul routes that minimize truck noise in residential areas. Amtrak will also establish a community liaison program to ensure residents are kept informed of construction activities and have a means to register complaints.

Vibration from Construction. The project-generated construction vibration impacts are expected to be relatively minor. Catenary installation and bridge undercutting are expected to last no more than a few days at any one location, and therefore construction vibration from these activities would not exceed the impact threshold. Construction-generated vibration that would exceed the impact thresholds would be limited to small areas around one of the 25 electrification facilities and three of the bridge modifications and would involve a total of 16 residences.

The construction would take place intermittently and be of limited duration, ranging from 1 to 4.5 months at the bridge sites and approximately 2 to 4 months at the facility sites. In addition, the construction would normally be limited to weekday, daylight hours. Amtrak will mitigate these impacts by incorporating into construction contracts restrictions on the procedures and time permitted for vibration-intensive activities, such as pile-driving.

Noise from Operation of Facilities. The primary sources of noise at the electrification facilities would be from transformers and ventilation equipment associated with the Proposed Action. Of the 25 proposed facilities, noise from 12 identified in Table 4.4-5 may exceed the impact threshold at a total of 75 residences. Amtrak would mitigate these impacts by ensuring that final design of these facilities incorporates sound-absorptive barrier walls, quiet fans, fan silencers, or other measures to reduce expected noise levels to below impact thresholds.

Noise and Vibration from Train Operations. The noise and vibration impact that would result from future Amtrak intercity train operations is subject to a number of variables. The first is the actual performance of the equipment being acquired. Figures 4.4.1 and 4.4.2 show a significant range between different designs of specific trains. The other variable is the number of intercity trains. The Proposed Action itself would have a relatively small impact on existing noise at existing levels of service. Generally speaking, electric trains would be quieter and produce less vibration at comparable speeds than the non-electric equipment it would replace. The greater potential for impact is from the increased frequency and higher speeds of trains. The increased frequency and higher speeds of trains is not a direct result of the Proposed Action per se, but rather is the impact from NECIP as a whole. The extent to which higher levels will be achieved, and when they will be achieved is unknown.

The best approach to mitigating any impact is to lessen the impact itself which is referred to as source control. In this case that means lowering the noise and vibration emissions from the trains.

The next approach involves measures to lessen the impact of the resulting emissions. This may include path control for noise which would consist of the installation of solid, wayside noise barriers along the ROW. These barriers, which should be at least 200 feet long and are designed to block the direct sound path between the trains and noise-sensitive sites, would likely be one of the most effective measures to mitigate the projected noise impact. Although noise barriers are the most effective means of blocking noise, they could have adverse secondary impacts on sensitive views, particularly in the coastal regions of Connecticut and Rhode Island.

A third option involves receiver controls for noise, and includes sound-insulation treatment of buildings. Sound-insulation treatment includes additional window glazing, improvements in weather stripping around doors and windows, and sealing any holes in exterior surfaces. One disadvantage of sound-insulation treatment is that it works indoors only when doors and windows are closed and has no effect on noise in exterior areas. However, it may be the best choice for sites where noise barriers are not feasible, and for schools or churches where indoor noise sensitivity is most important.

Vibration levels could be reduced by any of these five measures: (1) installation of ballast mats, (2) installation of floating concrete slabs, (3) switching from concrete to wood ties, (4) construction of deep trenches parallel to the tracks between the tracks and sensitive receptors, or (5) operation at lower speeds in vibration-sensitive areas.

Mitigation Requirements -- Source Controls. A major opportunity exists in the design of Amtrak's new equipment. In this regard, Amtrak will, as part of its acquisition of new high-speed trainsets for use on the Northeast Corridor, give significant weight in the evaluation of competing designs to those that can demonstrate lower levels of noise and vibration emissions.

Additional opportunities exist in equipment maintenance. Amtrak will develop, as part of its NEC operating plan, an improved equipment maintenance program that includes addressing maintenance issues that translate into noise emissions, including the installation of equipment to detect wheel flats on a continuing basis, as well as periodic wheel truing and rail grinding. (The elimination of railroad-highway grade crossings would eliminate horn noise. However, as discussed in Chapter 4, the responsibility for decisions relating to the elimination of grade crossings rests with the states.)

Mitigation Requirements -- Massachusetts. The approach to noise and vibration mitigation in Massachusetts is different than in the other states because, in Massachusetts, Amtrak does not own the rail line; rather, it is a tenant of the MBTA. Furthermore, the MBTA operates more trains, louder trains, and trains later at night than Amtrak on the same track. In addition, after electrification, the noise emission characteristics of Amtrak trains would differ from the equipment used by the MBTA. All of this points to the need for a joint noise mitigation effort. It would make little sense to mitigate intercity train noise without addressing commuter train noise.

The MBTA is presently undertaking a comprehensive evaluation of noise emissions and impact from its system to develop a plan to mitigate this impact. Amtrak will participate with the MBTA in this evaluation of the noise emissions from operations on the NEC main line in Massachusetts and reach agreement with the MBTA on the allocation of financial responsibility for the mitigation identified. It is recommended that, at a minimum, the MBTA and Amtrak incorporate the measures outlined for Rhode Island and Connecticut below.

In its comments on the DEIS/R, the MEPA Unit pointed out that certain funds remained from an appropriation to Amtrak to mitigate noise in the Boston area, and suggested that those funds be expended now as part of a noise reduction program. FRA does not disagree and recommends that Amtrak and the MBTA use these funds to develop and construct prototype noise barriers to be used in technical evaluations and in discussions with City and community officials and residents on the acceptability of various designs. It is recommended that, because of the noise impact experienced from existing rail operations on the NEC, these prototype barriers be demonstrated at an appropriate site in the City of Boston.

Mitigation Requirements -- Rhode Island and Connecticut. This measure addresses the noise-sensitive receptors identified as being impacted by the Proposed Action at the initiation of electric service in Rhode island and Connecticut where it is owned by Amtrak. Prior to initiation of electrified operations, Amtrak, in consultation with the owners of the properties identified in Section 4.4 as impacted by the "initial build," and appropriate state and local agencies will develop and implement a plan to mitigate noise and vibration impacts of its high-speed intercity service. Amtrak will also develop and implement a plan to minimize the vibrations from high-speed intercity service. These plans would be consistent with the then-current FRA guidance on the mitigation of noise and vibration impacts of high-speed rail systems. In the absence of such guidance, the plan would be consistent with the then-current guidance by the Federal Transit Administration on the mitigation of noise and vibration impacts from commuter rail projects.

Vibration Mitigation Testing. This measure addresses concerns as to which vibration mitigation measures are most effective, since such measures have not been previously used in the high-speed intercity rail environment in the U.S. Within 2 years of the start of construction, Amtrak will develop and implement a plan to evaluate the relative effectiveness of measures to suppress the transmission of vibration from the high-speed rail track to sensitive structures adjacent to the right-of-way. Should Amtrak not wish to conduct this evaluation on the NEC main line, FRA will arrange to make its Transportation Test Center at Pueblo, CO, available for this purpose.

Monitoring and Long-Term Mitigation Plan. This measure addresses the uncertainty as to the actual noise and vibration emissions from high-speed operation and the potential that additional sensitive receptors would be impacted by noise as rail traffic, both intercity and commuter, increases. Prior to the initiation of electric train operation, Amtrak will, in consultation with the appropriate state transportation and environmental protection agencies, develop a program of monitoring the noise and vibration effects of rail operations on the NEC at sites identified as susceptible to adverse noise impacts in Section 4.4.

In consultation with the respective state DOTs, Amtrak will develop a plan to mitigate the noise and vibration impacts at sensitive receptors identified through monitoring as exceeding the thresholds for mitigation contained in the then-current FRA guidance on the mitigation of noise and vibration impacts of high-speed rail systems. In the absence of such guidance, the plan would be consistent with the then-current guidance by the Federal Transit Administration on the mitigation of noise and vibration impacts from commuter rail projects.

5.1.1(e) Electromagnetic Fields

Concerns over electromagnetic fields (EMF) are related to two different aspects of the Proposed Action, the fixed facilities (e.g., power lines, substations, switching stations, and paralleling stations) and the overhead catenary system. These concerns, in turn, are related primarily to potential impacts on health and, to a lesser extent, potential electromagnetic interference and compatibility (EMI and EMC) with adjacent facilities including communications, cathodic protection systems, and induced currents in adjacent metallic structures.

EMF. There is no scientific consensus on the nature of EMF implications on human health and the levels of EMF that might be of concern. The levels of EMF generated by the Proposed Action are significantly lower than existing state or foreign standards. In the absence of a scientific consensus, however, prudence suggests other measures be incorporated into the project.

The overhead catenary system and power transfer facilities design has been shown to minimize environmental EMF along the right-of-way in over a decade of operation powering the TGV system in France. The out-of-phase currents in the catenary and return feeder provide a partial magnetic field cancellation (except for the passengers in the current loop). At 30 feet from the track, the EMF due to this design is about half that produced by each overhead wire's current. In addition to EMF field reduction, this design offers EMI minimization at the source. As a consequence, no specific changes are recommended in the overhead catenary design.

With regard to other fixed facilities (substations, paralleling stations, and switching stations) Amtrak will site the facilities to ensure the maximum buffer space to adjacent residential land use, enclose the entire facility site with a fence with appropriate warning signs, and use "best industry practice" for the minimization of EMF.

In addition, Amtrak will, in cooperation with FRA and in consultation with interested state and local environmental, health, and transportation agencies, establish a program to monitor EMF at sensitive receptors adjacent to the catenary system and electric power facilities developed as part of this project.

EMI and EMC. With regard to electromagnetic interference and compatibility concerns, Amtrak, in consultation with the respective state public utilities commissions, will incorporate into its final design appropriate measures to minimize signal interference, degradation of existing cathodic protection systems, and induced currents in adjacent metallic structures, including pipes. The measures will include applicable portions of IEEE Standard 80-1986, IEEE Standard 487-1980, IEEE Standard 367-1987, and IEC Standard 909-1988.

5.1.1(f) Energy

The U.S. Environmental Protection Agency has undertaken a program called "Green Lights" to promote the use of energy efficient lighting technologies because of their benefits in energy savings and reducing pollutants caused by electricity generation. Amtrak will incorporate energy efficient lighting technologies as an integral feature of all facilities developed or improved as part of this project.

5.1.1(g) Archaeology

Each of the electrification facilities and bridges was assessed as having a low potential for containing archaeological remains except the New London Substation utility corridor, which has a moderate ranking.

To mitigate any potential for impact in this area of concern, Amtrak will require that the trench excavation for the feeder line be monitored by professional archaeologists to identify, collect, and catalogue possible important historic resources. In addition, Amtrak will include in its construction contracts provisions that provide for retrieval and professional investigation of any archaeological artifact discovered as part of earthwork.

5.1.1(h) Public Safety

There are two public safety impacts that might benefit from requiring specific mitigation measures. These are impacts involving unauthorized persons on the ROW (trespassers), and persons at commuter stations by- passed by high-speed operation.

Trespassers. Studies for this FEIS/R identified 29 locations at which pedestrians regularly cross the NEC at illegal locations. The potential for hazards at these locations would increase due to increased speeds and frequency of trains.

No measure to control trespassing on railroad property has been found to be completely effective; however, that is not a reason not to try to mitigate these impacts. The measure with the greatest potential to mitigate these concerns is education as offered by the joint government and industry program *Operation Lifesaver*. Another measure frequently mentioned as a way to keep unauthorized persons off railroad property is fencing. Past experience shows that fencing is not necessarily effective in preventing a determined trespasser, but may serve a purpose in delineating the area of unacceptable entry to others.

To address the potential public safety impacts to unauthorized persons on the ROW, Amtrak will, in cooperation with *Operation Lifesaver*, assist in the development of community and school educational programs, stressing the potential hazards associated with high-speed trains, and giving guidance on crossing the tracks at appropriate locations. At a minimum, this enhanced educational program will take place during the period beginning 6 months prior to the start of electric operations and extend through the first anniversary of electric operations.

Amtrak will, in consultation with the appropriate local authorities, fence its right-of-way in those areas identified in Table 5.1.1, which identifies areas with worn, well established paths, as well as along school yards, playgrounds, and other recreational areas. In the State of Massachusetts (where the rail corridor is owned by the MBTA), Amtrak will cooperate with the MBTA on an evaluation of the need for fencing the NEC main line and on developing a mechanism for allocating the financial responsibility for the installation of fencing between intercity (Amtrak) and commuter (MBTA) users of the NEC main line. In the interim, Amtrak will seek permission from the MBTA to install, as part of NECIP, fences at the locations indicated in Table 5.1-1. In addition, Amtrak will on a regular basis consult with local authorities to identify any new areas where significant levels of trespassing are occurring, and measures that might lessen trespassing.

It is recognized as well that, to some extent, the trespassing identified above results from persons trying to access recreational opportunities on the other side of the rail corridor that are not convenient to public crossings. Of particular concern are Connecticut State Parks at Haley Farm and Bluff Point. In consultation with the appropriate state park authorities, Amtrak will develop grade-separated pedestrian crossings of the NEC main line in these park areas, provided that the appropriate park authorities assume responsibility for development and maintenance of access paths. In addition, Amtrak, in consultation with the City of Groton, will upgrade the old cattle crossing under its tracks at the end of Neptune Drive for pedestrian travel, provided that the City assumes responsibility for its maintenance as well as for access paths.

Commuter Stations. Ten of the railroad stations along the NEC lack grade-separated pedestrian ways, requiring Amtrak passengers and commuters to cross the tracks. These include stations at Branford, Guilford, Madison, Mystic, Clinton, New London, Westbrook, and Old Saybrook, CT; Kingston, RI; and Canton Junction, MA. At an additional seven stations (Westerly, RI; and South Attleboro, Attleboro, Mansfield, Sharon, Route 128, and Hyde Park, MA), low-level platforms permit pedestrians to cross the tracks at grade, even though there are tunnels or bridges which could be used to avoid crossing the tracks at grade. Although the impacts are considered relatively minor, the close proximity of the station platforms to high-speed express trains creates concerns over the safety of persons at these stations who may not be aware of approaching trains. To address these concerns, Amtrak will work with the state agencies responsible for commuter rail service to install a system that provides a visual and audible warning of an approaching train at all stations where speeds can exceed 40 mph or where visibility along the tracks is impaired by curves or obstructions.

TABLE 5.1-1 Fencing Locations

LOCATION	APPROXIMATE MILEPOST	APPROXIMATE LENGTH (ft)
Railroad Avenue, Madison, CT	92.8	1,200
Privateer LTD, Clinton, CT	96.0	900
Broadway Street, Westbrook, CT	99.2	800
Westbrook Heights Road, Westbrook, CT	101.3	1,000
Boston Post Road East, Old Saybrook, CT	105.2	1,600
Near Shore Road, Old Lyme, CT	107.6	1,200
Rocky Neck State Park, East Lyme, CT	112.7	repair break
Ridgewood Drive, East Lyme, CT	113.8	500
Gada Road, East Lyme, CT	114.8	900
Near MP 115.8	115.8	repair break
Hole in the Wall Beach	115.9	200
Grand Street, East Lyme, CT	116.2	repair break
Niantic River Bridge	116.7	1,000
Haley Farm State Park	128.3	900
Spicer Avenue, Groton, CT	130.3	900
Near Milepost 136.2	136.2	1,200
Old Baptist Road, Warwick, RI	168.5	1,100
Rocky Hollow Road, Warwick, RI	170.0	5,400
Queen Street, Warwick, RI	171.5	480
Alger Avenue, Warwick, RI	172.9	150
Folly Landing, Warwick, RI	173.9	275
Knight Street, Hebronville, MA	193.7	900
Oak Street, Attleboro, MA	197.8	repair break
Morse/Summer Place, East Foxboro, MA	206.0	1,450
Manomet Street, Sharon, MA	208.2	440
Mohawk Street, Sharon, MA	208.5	880
Garden Street, Sharon, MA	209.5	1,265
Dale Street, Hyde Park, MA	221.8	repair break
Grew Avenue, Roslindale, MA	222.0	repair break
TOTAL	----	24,640

Source: DMJM/Harris, 1994

5.1.1(i) Traffic, Transportation, and Circulation

Highway Impacts during Construction. In order to obtain adequate clearance for the installation of the catenary, seven overhead roadway bridges would be modified. This construction would affect the ability of highway traffic to use these bridges during the construction period, which would range from 2.5 to 4.5 months. Construction at all but one of these bridges would require closing of the bridge to traffic. Raising of the Burdickville Road Bridge could be staged so that vehicular traffic would be maintained during construction, by regulating traffic with signals at either end of the bridge. At any given time, traffic flow across the bridge could be permitted in one direction only. Traffic volumes on this bridge are very light (daily: 151; AM peak: 13; PM peak: 10). Other roads would require detours.

To minimize the adverse impact on highway traffic during construction, Amtrak will develop and implement a detour plan, in cooperation with appropriate public officials responsible for the roads crossing these bridges.

Other Rail Users. The Proposed Action has the potential to adversely affect commuter and freight rail service using the NEC main line in two ways. First, during construction of the electrification project, commuter and/or freight service may be held up for construction trains, or service might be disrupted due to work equipment occupying tracks. Second, after completion, the higher speeds achievable by electric trains might create conflicts with slower moving commuter and freight trains. These impacts will be mitigated in the following ways:

Construction: Prior to the commencement of construction, Amtrak will develop a priority for track access that would be used for dispatching trains during the construction period, except during emergencies. The priorities, in descending order (other than in those circumstances where such priority is inconsistent with existing contracts), shall be: (1) intercity revenue trains, (2) commuter revenue trains, (3) freight revenue trains, (4) scheduled deadhead passenger equipment moves, (5) intercity non-revenue trains, (6) commuter non-revenue trains, and (7) freight non-revenue trains. Amtrak will also maintain a system where freight rail operators can arrange in advance for special movements during evening hours. Amtrak will train its dispatchers, work crews, and contractors to ensure their knowledge of the priority for occupancy of tracks, and develop a reliable and enforceable system for ensuring the appropriate priorities are assigned commuter and freight revenue movements.

To address the problems associated with storing work equipment on active tracks required for commuter or freight service, Amtrak will, prior to the start of construction activities, prepare and submit to FRA for its review and approval a plan that identifies storage tracks and yards to be used to meet the needs of storing all equipment being used or positioned for construction without interfering with commuter operations or access to freight rail customers.

Operation: To accommodate the different speeds of trains using the NEC after completion of the electrification project, Amtrak will, prior to the initiation of service at speeds in excess of those presently operated, improve or reinstall the side tracks, turnouts, crossovers, and other trackwork, as described in Appendix F of the Northeast Corridor Master Plan dated July 1994, in the following locations:

- north side of main at or near MP 83.2 (Pine Orchard)
- north and south of main at or near MP 89 (Guilford)
- south of main at or near MP 96 (Clinton)
- north and south of main at or near MP 105 (Old Saybrook)
- MP 120 (number 20 crossover)
- MP 143
- north of main at or near MP 176 (Hills Grove)
- south of main at or near MP 179 (Cranston; includes reconfigured crossover at MP 179)
- north of main from Atwell (MP 184.2) to Lawn (MP 188.5) [upgrade to FRA Class 3 with historic (maximum size moved within the last 10 years) clearances]
- north of main at or near MP 196-197 (Thatcher)

- reconfigure turnouts and crossovers south of main between MP 193 and MP 199 (Hebronville and Attleboro)
- add parallel diverging route and siding on Stoughton Branch near MP 214 (Canton Junction)

To address the concern that during the winter frozen switches would prevent local freight trains from serving industries during the main line track windows available to them, Amtrak will, prior to the initiation of service at speeds in excess of those presently operated, install switch heaters at the following locations:

- all interlocking switches and switches leading to passing sidings between MP 73 and MP 218
- MP 90.8 (Landon Lumber)
- 96.3 (Stanley Bostich)
- MP 103.8 (R.R. Donnelley)
- MP 104.5 (Fortune Plastics)
- MP 104.5 (Valley Railroad, both legs of wye)
- MP 120.0 (Hendels Gas)
- MP 122.6 (Central Vermont yard, all switches leading into yard)
- MP 124.5 (Track 4 Groton to Midway, both legs of wye)
- MP 157.4 (Arnold Lumber)
- MP 169.7 (Grossmans Lumber)
- MP 174.5 (G.M. Gannon)
- MP 176.7 (Narragansett Lumber)
- MP 177.8 (Georgia Pacific Lumber)
- MP 181.2 (Track 5 Cranston, Spaulding Brick)
- MP 187.2 (West River industrial Track)

Note: The locations of the sidetracks identified above have been evaluated by FRA. They involve the rehabilitation or restoration of previously used tracks on the existing roadbed, and no adverse impact on any area of environmental concern is anticipated.

To address the concerns that the catenary could impact upon the clearances presently used by freight rail cars, Amtrak will ensure that the catenary and other structures developed as part of the extension of electric traction from New Haven to Boston provide clearances adequate to handle existing loads under energized catenary. It will also ensure that special high/wide loads historically moved (maximum size moved within the last 10 years) over any specific segment of the NEC main line can be accommodated under deenergized catenary in special train moves.

Marine Users of Amtrak's Moveable Bridges. Concern has been expressed that the Proposed Action and related NECIP improvements would decrease the access available for marine traffic through the five moveable bridges between Old Saybrook and Mystic.

To address the availability and reliability of access by marine traffic through the moveable bridges, Amtrak will, prior to operating trains with a frequency per day significantly greater than that presently operated during the summer months, develop an agreement with the U.S. Coast Guard covering operation of the moveable bridges at the Connecticut River, Niantic River, Shaw's Cove, Thames River, and Mystic River.

This agreement will address measures necessary to provide adequate and reliable access for marine traffic through these bridges including such issues as scheduling of trains and related bridge operations, reliability of rail operations, training of dispatchers and bridge tenders, maintenance, notification to mariners, and other appropriate issues. Input and comment will be sought from other users of the bridges including the U.S. Navy, ConnDOT, and commercial and recreational mariners.

Coordination with Other Transportation Projects. Concern was expressed in comments on the DEIS/R about potential problems that could arise if the Proposed Action was not coordinated with the Central Artery/Tunnel

(CA/T) Project in Boston being developed by the Massachusetts Highway Department. Since the DEIS/R, engineers for both the Proposed Action and the CA/T Project have begun regular meetings and developed a forum for coordinating their efforts. No further measures appear warranted to address this concern.

Increased Parking Demand at Railroad Stations. Existing parking at the train stations at Route 128, Providence, and New Haven exceeds the demand expected from intercity rail passengers in 2010 assuming that this project and the remainder of NECIP are implemented and the demand for rail service corresponds with projections. These impacts are not part of the Proposed Action per se but result from NECIP as a whole. Therefore, their mitigation is not addressed here, but rather in the Northeast Corridor Transportation Plan. Expanded parking is planned in New Haven and Providence that could meet the intercity needs. Amtrak has agreed with the MBTA to aid the analysis of alternative approaches to providing parking at the Route 128 Station for both commuters and intercity passengers, and the MBTA will be responsible for any required environmental documentation associated with improvements at the Route 128 Station. Amtrak will contribute to the funding of parking improvements required by increased intercity ridership.

5.1.1(j) Air Quality

The Proposed Action would create substantial air quality benefits. The air quality concerns relate to construction of the project facilities. Construction-related activities from the Proposed Action could result in short-term impacts on ambient air quality in the vicinity of the construction site. These potential impacts include fugitive dust emissions, direct emissions from construction equipment and truck exhausts, and increased emissions and dust from construction vehicles on the streets. Six of the 25 electrification facility sites and four of the seven bridge modification sites are located close to residences and other sensitive receptors that may be affected by construction-related air quality impacts.

To minimize these impacts, Amtrak will require that all contractors and persons involved in construction of this project use Best Management Practices (BMP) to control fugitive dust from the construction sites and from construction vehicles. Amtrak will also require that construction equipment used on this project be in good repair, be in tune, and minimize the exhaust of pollutants.

5.1.1(k) Visual and Aesthetics

Views from a number of visually sensitive receptors (VSR) could be affected by the proposed catenary system. Forty-two of the potential 225 VSRs identified in this FEIS/R could be adversely impacted almost exclusively from intrusion of the catenary supports or poles into scenic vistas. To minimize these impacts, Amtrak would ensure as part of final design that, to the extent practicable, catenary poles are placed to avoid the views from the VSRs identified in Table 3.11.1.

The proposed Roxbury Crossing Substation and Noank Paralleling Station may be architecturally out of character with the neighborhood surrounding these proposed facilities sites. To limit the visual intrusion of these sites (subject to FRA reserving its decision on selection of the Roxbury site), Amtrak will enclose the Roxbury Crossing Substation in a structure that is compatible in material and style with the surrounding neighborhood. For the Noank site, Amtrak will identify any practicable measures to modify the design of the gantry so it is less obtrusive.

5.1.1(l) Natural Resources

Endangered and Threatened Species. The Proposed Action has the potential to impact the following endangered, threatened or rare species:

- Shortnose sturgeon in the Connecticut River
- American bittern near the Stonington Paralleling Station
- Osprey near the Kingston Paralleling Station site
- Winter flounder, anadromous fish, and shellfish which are aquatic Species of Concern and found at the location of the five moveable bridges

To minimize these impacts, Amtrak will not permit construction in the vicinity of these species habitat during those periods of time identified by the state as when they are most at risk. These periods are:

- Shortnose sturgeon: April 1 through August 15
- American bittern: May 1 through August 15
- Osprey: March 15 through August 15
- Winter flounder: February 1 through May 30
- Anadromous fish: April 1 through June 30
- Shellfish: June 1 through September 30

Comments on the DEIS/R suggested that additional osprey nesting poles be placed in the Great Swamp Management Area. Amtrak has agreed to cooperate with RIDEM in this regard and no additional measures are required as part of this FEIS/R.

Wetlands and Water Resources. Construction of portal structures to accommodate a possible third track for freight service to be built by the State of Rhode Island would require the permanent use of wetlands in three locations totaling less than 100 square feet. To address this potential impact, Amtrak will utilize (where practicable) alternative catenary supports to avoid use of wetlands. To the extent that wetlands would be required, Amtrak will develop, in consultation with RIDEM and the U.S. Army Corps of Engineers, plans to ensure the minimum possible disturbance of wetlands during construction and for compensation of the wetlands used as part of this project. Amtrak will relocate the proposed route of the access road to the Leetes Island Paralleling Station to avoid intrusion into the adjacent wetland.

A number of the proposed electrification facility sites and bridge modifications are located in close proximity to wetlands, rivers, aquifers, streams, and other water resources. Adverse impacts to these resources are possible during construction of the project. The sites are: the Kingston Paralleling Station, and the five moveable bridges. To limit the possible adverse impacts during construction in these areas, Amtrak will ensure that the designs for facilities and bridge locations avoid the resource to the maximum extent possible. This will include locating the facility as far from the resource as possible and minimizing the size of its footprint. The designs will also incorporate the construction of swales to remove nutrients and suspended material, and the construction of infiltration trenches or basins.

During construction, Amtrak will ensure that its employees utilize BMPs for working in aquifer protection areas. BMPs are structural or nonstructural practices that are determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources (e.g., stormwater runoff and construction development practices) in order to achieve state water quality goals.

To mitigate the potential for sedimentation, siltation, or contamination of water resources, Amtrak will ensure that its employees and contractors utilize proper erosion and sedimentation control measures, including the use of hay bales, silt fencing, and other barrier methods during construction.

Other steps to be taken during construction would include: (1) staging equipment and construction materials on impervious surfaces or outside protected area; (2) vehicle maintenance and storage outside the protected area; and (3) development of spill contingency plans in case of an accidental release of potential contaminants.

Herbicides would not be used during construction. With regard to long-term maintenance of facilities developed as part of this project, there will be absolutely no herbicide spraying within a sole source aquifer, within delineated wellhead protection areas, within 400 feet of surface water supply sources or tributaries thereto, or within 100 feet of private wells.

Potential Disturbance of Wildlife Habitat. The site for the proposed Kingston Paralleling Station is within a critical wildlife habitat that could be adversely affected by construction of the proposed facility. Plans for construction of this facility would be approved in advance by RIDEM. At a minimum, these plans will locate

the facility away from the large oak tree on the site and screen the facility with plantings of shrub species that provide food, cover, and nesting opportunities for birds and small mammals. (See the Section 4(f) Statement in Appendix G.)

5.1.1(m) Hazardous and Solid Waste

Facilities Construction. During construction there is a potential for discovering contamination from the excavations. Sites of particular concern include: Leetes Island, Madison, Old Lyme, Millstone, Bradford, Exeter, Providence, Canton, Readville, and Roxbury Crossing. To avoid possible adverse impacts, Amtrak will require as part of its construction contracts that surplus material excavated from the sites identified be tested prior to leaving the site. These tests will be structured to determine consistency with applicable Federal and state regulations governing disposal of such materials. All materials generated by construction activities will be disposed of in compliance with all applicable Federal and state regulations.

Bridge Modifications. Only one bridge, Park Avenue, is constructed of steel and therefore likely coated with lead-based paint. To avoid possible lead contamination, Amtrak will test this bridge to determine whether lead is present. If lead is found to be present, the painted portions would be contained to minimize the release of lead bearing dust into the environment.

Undercutting Sites. Initial field screening found TPH concentrations at two locations which exceeded Massachusetts reporting concentrations for certain soil classifications. As a consequence, disposal of spoil generated by undercutting may require special handling. To address this concern, Amtrak will share with the appropriate state agency the results of these tests and perform such additional tests as the states may require at representative sites proposed for undercutting to determine whether the undercutting spoil would qualify as a hazardous waste in these states. Amtrak will ensure that this spoil is disposed of in a manner consistent with applicable Federal and state regulations.

Catenary Pole Installation. Since foundation drilling for catenary poles would also extract material directly from the right-of-way, it would have a potential for contamination. Therefore, prior to construction Amtrak will sample displaced fill at representative locations for the existence of hazardous materials, and incorporate into project plans appropriate removal and disposal measures.

5.1.2 Site-Specific Mitigation

Table 5.1-2 summarizes, on a site-specific basis, potential impacts and the mitigation that would be incorporated into the project to lessen these impacts.

TABLE 5.1-2 Potential Impacts and Mitigation at Facility Sites and Roadway and Railroad Bridges

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
Olive St. Bridge New Haven, CT MP 73.08	Solid barrier would obscure &/or physically alter National Register-eligible resource	Redesign barriers or find less intrusive method for protecting public from catenary in consultation with the SHPO as part of the MOA
Ferry St. Bridge New Haven, CT MP 74.38	Solid barrier would obscure &/or physically alter National Register-eligible resource	Redesign barriers or find less intrusive method for protecting public from catenary in consultation with the SHPO as part of the MOA
Branford SS Branford, CT MP 79.26	Operational noise at one residence	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Contamination of private wells	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
	Siltation, sedimentation, or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; construct vegetated swales; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
Leetes Island PS Guilford, CT MP 85.99	Operational noise at 1 residence	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Construction noise at 1 residence for 2-3 months	Noise control requirements in specifications[2]; keep community informed of work schedule
	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
	Facility could impact Rt. 156 Historical District	Further consultation with the SHPO as part of the MOA
Madison PS Madison, CT MP 92.41	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site

TABLE 5.1-2 Potential Impacts and Alternatives for Mitigation at Facility Sites and Roadway and Railroad Bridges (Continued)

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
Grove Beach PS Westbrook, CT MP 99.11	Operational noise at 15 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Construction noise at 2 residences for 2-3 months	Noise control requirements in specifications[2]; keep community informed of work schedule
	Construction vibration at 2 residences for 2-3 months	Restrict procedures & times for pile driving; require vibration monitoring to certify compliance with vibration limits; notify residents of duration & hours of construction
	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
Westbrook SwS, Westbrook, CT MP 103.53	Operational noise at 1 residence	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
Connecticut River RR Bridge Old Saybrook, CT MP 106.89	Installation of catenary/alteration of National Register-eligible resource	Further consultation with the SHPO as part of the MOA
Johnnycake Hill Rd. Bridge Old Lyme, CT MP 108.51	Construction noise at 1 residence for 1 month	Noise control requirements in specifications[2]; keep community informed of work schedule
	Construction vibration at 1 residence for 1 month	Restrict procedures & times for pile driving; require vibration monitoring to certify compliance with vibration limits; notify residents of duration & hours of construction
Old Lyme PS Old Lyme, CT MP 109.50	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site

TABLE 5.1-2 Potential Impacts and Alternatives for Mitigation at Facility Sites and Roadway and Railroad Bridges (Continued)

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
Rocky Neck Park Trail Br. Old Lyme, CT MP 112.74	Solid barrier would obscure &/or physically alter National Register-listed resource	Redesign barriers or find less intrusive method for protecting public from catenary in consultation with the SHPO as part of MOA
Niantic R. RR Bridge East Lyme, CT MP 116.74	Installation of catenary/alteration of National Register-eligible resource	Further consultation with the SHPO as part of the MOA
Millstone Road West Waterford, CT MP 117.31	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
	Siltation, Sedimentation, or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
New London SS New London, CT MP 123.55	Operational noise at 2 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Disturbance of intact buried cultural remains in utility corridor	Monitoring by professional archaeologist during construction
Thames R. RR Br. New London, CT MP 124.09	Installation of catenary/alteration of National Register-eligible resource	Further consultation with the SHPO as part of the MOA
Noank PS Groton, CT MP 129.46	Operational noise at 5 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
	Siltation, sedimentation or contamination of wetland during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to stream: stabilize slopes; stage & repair construction equipment & vehicles off-site
	Station out of scale & character with existing neighborhood	Redesign out of character components

TABLE 5.1-2 Potential Impacts and Alternatives for Mitigation at Facility Sites and Roadway and Railroad Bridges (Continued)

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
State Line PS Stonington, CT MP 139.93	Operational noise at 5 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Contamination of sole source aquifer	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
West St. Bridge Westerly, RI MP 141.67	Solid barrier obscure &/or physically alter National Register-eligible resource	Redesign barriers or find less intrusive method for protecting public from catenary in consultation with the SHPO as part of the MOA
Stonington PS Stonington, CT MP 143.65	Disturbance of state-listed endangered species habitat	Avoid construction between the nesting period of May 1 and August 15
Bradford PS Bradford, RI MP 145.19	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
	Contamination of sole source aquifer & water supply wells	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
Burdickville Rd. Bridge Charlestown, RI MP 148.41	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
	Contamination of sole source aquifer	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
Richmond SwS Richmond, RI MP 150.35	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
	Contamination of sole source aquifer	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide

Table 5.1-2 Potential Impacts and Alternatives for Mitigation at Facility Sites and Roadway and Railroad Bridges (Continued)

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
Kenyon School Rd. Bridge Richmond, RI MP 154.04	Construction noise at 7 residences for 3 months	Noise control requirements in specifications[2]; keep community informed of work schedule
	Construction vibration at 6 residences for 3 months	Restrict procedures & times for pile driving; require vibration monitoring to certify compliance with vibration limits; notify residents of duration & hours of construction
	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
	Contamination of sole source aquifer	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
	Historic character of the historic district could be impacted by modern bridge structure	Consultation with the SHPO as part of the MOA
Kingston PS Kingston, RI MP 157.11	Diminish quality of high value wildlife habitat	Preserve large oak tree; locate facility as far away as possible from tree; plant native shrub species around facility
	Contamination of sole source aquifer	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
	Use of 4(f) protected property	Compensate RIDEM by funding acquisition of additional land
RI Route 138 Bridge South Kingstown, RI MP 158.32	Solid barrier would obscure and/or physically alter National Register eligible resource	Redesign barriers or find less intrusive method for protecting public from public from catenary in consultation with the SHPO as part of the MOA
Exeter PS Exeter, RI MP 161.78	Contamination of sole source aquifer & protected groundwater	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
	Facility could impact W. R. Slocum House	Placement of catenary poles in consultation with the SHPO and photographic recordation
Hunt's River Road Bridge N. Kingstown, RI MP 169.79	Solid barrier would obscure &/or physically alter National Register-eligible resource	Redesign barriers or find less intrusive method for protecting public from catenary in consultation with the SHPO as part of the MOA

TABLE 5.1-2 Potential Impacts and Alternatives for Mitigation at Facility Sites and Roadway and Railroad Bridges (Continued)

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
E. Greenwich PS N. Kingstown, RI MP 169.80	Contamination of sole source aquifer & water supply wells	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
Greenwood (RR) Bridge Warwick, RI MP 175.70	Solid barrier would obscure and/or physically alter National Register recommended eligible resource	Redesign barriers or find less intrusive method for protecting public from catenary in consultation with the SHPO as part of MOA
Warwick SS Warwick, RI MP 176.91	Displacement of lumber business	Relocation of business in suitable location in accordance with requirements of Federal Uniform Relocation Assistance Act of 1970
	Operational noise at 34 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Construction noise at 5 residences for 4 months	Noise control requirements in specifications[2]: keep community informed of work schedule
Pettaconsett Ave. Bridge Warwick, RI MP 178.46	Construction noise at 12 residences for 4.5 months	Noise control requirements in specifications[2]: keep community informed of work schedule
	Construction vibration at 7 residences for 4.5 months	Restrict procedures & times for pile driving; require vibration monitoring to certify compliance with vibration limits; notify residents of duration & hours of construction
	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
Park Ave. Bridge Cranston, RI MP 180.29	Degradation of traffic operating conditions during construction, from LOS D to LOS E at Park Ave./ Elmwood Ave. intersection	Temporarily reassign eastbound left turn & through lanes of Park Avenue to left turn only & change signal phasing to support
Elmwood PS Providence, RI MP 181.707	Facility could impact Gorham Plant Complex	Further consultation with the SHPO as part of the MOA
Central St. Pedestrian Viaduct Central Falls, RI MP 190.00	Solid barrier would obscure &/or physically alter National Register-eligible resource	Redesign barriers or find less intrusive method for protecting public from catenary in consultation with the SHPO as part of the MOA
Blackstone R. RR Bridge MP 190.55	Installation of catenary/alteration of National Register-eligible resource	Installation of the catenary as stipulated in the MOA

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
Attleboro PS Attleboro, MA MP 193.40	Operational noise at 2 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Siltation, sedimentation or contamination of Ten Mile River during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to river; stabilize slopes; stage & repair construction equipment & vehicles off-site
Norton SwS Attleboro, MA MP 198.99	Displacement of residence	Relocate residents in comparable setting in accordance with requirements of Federal Uniform Relocation Assistance Act of 1970
	Operational noise at 1 residence	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Siltation, sedimentation or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
	Contamination of protected groundwater	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
E. Foxboro PS Foxboro, MA MP 205.70	Operational noise at 2 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
Maskwonicut St. Bridge Sharon, MA MP 211.62	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
	Raising of bridge could adversely affect adjacent stone arch	Further consultation with the SHPO as part of the MOA
	Siltation, sedimentation or contamination of wetlands, Beaver Brook & its fisheries, during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
	Contamination of protected groundwater & water supply wells	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
Canton PS Sharon, MA MP 212.40	Siltation, sedimentation, or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site

TABLE 5.1-2 Potential Impacts and Alternatives for Mitigation at Facility Sites and Roadway and Railroad Bridges (Continued)

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
E. Greenwich PS N. Kingstown, RI MP 169.80	Contamination of sole source aquifer & water supply wells	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
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Elmwood PS Providence, RI MP 181.707	Facility could impact Gorham Plant Complex	Further consultation with the SHPO as part of the MOA
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Blackstone R. RR Bridge MP 190.55	Installation of catenary/alteration of National Register-eligible resource	Installation of the catenary as stipulated in the MOA

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Norton SwS Attleboro, MA MP 198.99	Displacement of residence	Relocate residents in comparable setting in accordance with requirements of Federal Uniform Relocation Assistance Act of 1970
	Operational noise at 1 residence	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
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	Raising of bridge could adversely affect adjacent stone arch	Further consultation with the SHPO as part of the MOA
	Siltation, sedimentation or contamination of wetlands, Beaver Brook & its fisheries, during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site
	Contamination of protected groundwater & water supply wells	Construction staging, equipment storage & vehicle maintenance outside protected area; develop spill contingency plans for accidental release of contaminants; cut vegetation rather than spraying with herbicide
Canton PS Sharon, MA MP 212.40	Siltation, sedimentation, or contamination of wetlands during construction	Erosion & sedimentation control (hay bales, silt fencing, etc.) during construction; maximize distance to wetland; minimize footprint; stabilize slopes; stage & repair construction equipment & vehicles off-site

TABLE 5.1-2 Potential Impacts and Alternatives for Mitigation at Facility Sites and Roadway and Railroad Bridges (Continued)

FACILITY[1] OR BRIDGE/LOCATION	POTENTIAL IMPACT	MITIGATION
Canton Viaduct Canton, MA MP 213.74	Installation of catenary/alteration of National Register-listed resource	Further consultation with the SHPO as part of the MOA
Fowl Meadow ACEC MP 214	Impacts to MA listed endangered species	
Readville PS Boston, MA MP 219.10	Operational noise at 6 residences	Measures such as sound absorptive barrier walls, quiet fans or fan silencers
Roxbury Crossing SS Boston, MA MP 226.02	Fugitive dust, truck & equipment exhaust during construction	Wet or chemically treat exposed earth; cover dust producing material during transport; limit construction during high winds; keep trucks clean & route away from residential areas
	Station out of scale & character with existing neighborhood	Enclose substation in building or provide screening compatible with the character of the neighborhood

1 SS = Substation/Utility Corridor; SwS = Switching Station; PS = Paralleling Station; RR = railroad (bridge)

2 Select equipment and techniques that generate lowest noise levels, use mufflers, certify compliance with noise limits by monitoring, select haul routes that minimize truck noise to surrounding communities

5.2 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

This section addresses in general terms the relationship of local short-term impacts and use of resources and long term productivity of the alternatives considered in the FEIS/R.

The Proposed Action is an important part of a comprehensive program that would result in a major reorientation of intercity travel in the Boston to New York City corridor, with a significant growth in the number and percentage of intercity travelers using rail passenger service. Encouraging the increase in intercity rail use is an integral part of the transportation plans of the states in the region. This project would also result in economic and environmental benefits, including the creation of jobs, the reduction of vehicular congestion around the region's airports, reduced energy use, and improved air quality improvements, as detailed in Chapter 4.

The total construction period for the proposed project would be approximately 3 years. In general, construction of the project has been planned to minimize impacts to the environment by maintaining existing Amtrak, commuter, and freight operations on the NEC and maintaining or detouring traffic flows on the overhead bridges to be modified. Measures to mitigate other construction impacts are presented in Section 5.1 of this chapter.

In consideration of the benefits to be derived from the Proposed Action, the short-term use of resources required to implement it is consistent with the maintenance and enhancement of the long-term productivity of the southern New England region.

The No-Build Alternative - AMD-103 Scenario would represent the future conditions without further investment in improved rail service. As a consequence, there are no short-term uses or long-term benefits associated with this scenario. The No-Build Alternative - FF-125 Scenario would require none of the construction associated with the Proposed Action. It would achieve some, but not all, of the transportation benefits of the Proposed Action but at the expense of additional impacts in such areas as energy consumption and air pollutant emissions. The No-Build Alternative - FRA-150 Scenario is not a short-term option. While it might eventually achieve many of the benefits of the Proposed Action with fewer of the additional impacts associated with the FF-125 scenario, it is unclear when this scenario could to be implemented. It would involve a substantial delay in realizing the long-term benefits of high-speed rail service.

5.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The proposed electrification project would require certain irreversible and irretrievable commitments of resources. Irretrievable human resources will be expended for the planning, design, construction and operation of the electrification and the electrified railroad. Planning, design and construction are estimated to require approximately 1.5 million person-hours per year for 3 years.[1] Approximately 280 new full-time permanent positions would be created by the electrification project, consuming approximately 600,000 person-hours annually.

Approximately 4.5 acres of land would be permanently acquired to site the electrification facilities. This does not include the existing NEC or electrification facility sites that Amtrak currently owns. This would represent an irreversible commitment during the time period that the land is in use for the railroad electrification. Currently, there is no reason to believe that this land could not be converted to another use or that such conversion would be necessary or desirable.

Construction of the proposed electrification would result in the consumption of tangible raw materials including approximately 13,000 steel poles, 1,000 miles of copper wire, and sufficient concrete to secure the footings of the poles.

The Proposed Action would also require the commitment of a substantial amount of Federal funds in an era of diminishing availability of Federal discretionary funds. Approximately $360 million would be required to implement the Proposed Action, of which $292.8 million has been already been appropriated.

There would be no irreversible or irretrievable commitment of resources associated with the No-Build Alternative scenarios other than the materials committed to equipment and the fuel consumed by intercity rail operations.

5.4 FEDERAL AND STATE ENVIRONMENTAL PERMITS REQUIRED

After formal and informal coordination with Federal, state, and local resource agencies, several permits and approvals processes were identified that must be completed as part of the Proposed Action. These and other state and Federal permits and approvals that may be necessary for project construction are shown in Table 5.4-1.

TABLE 5.4-1 Potential State and Federal Permits and Approvals Required for the Proposed Electrification Project

PERMIT/POLICY/ GUIDELINE	REGULATORY AUTHORITY	APPLICABLE LAW OR REGULATION
FEDERAL		
Section 404 (b)(1) Permit	US Army Corps of Engineers	Section 404 of the Federal Water Pollution Control Act[1] (30 CFR 320-330)
Section 10 Permit	US Army Corps of Engineers	Section 10 of Rivers & Harbors Act of 1899 (33 CFR 320-330)
Section 401 Water Quality Certificate	Issued by states: MDEP, RIDEM, ConnDEP[2]	Section 401 of the Federal Water Pollution Control Act
Section 106 Consultation - Historic & Archaeological Resources (Completed)	Advisory Council on Historic Preservation (Federal) & State Historic Preservation Offices[3]	Section 106 of the National Historic Preservation Act (36 CFR 800)
Bridge Permit	U.S. Coast Guard	(33 CFR Sect. 114-115)
FAA Form 7460-1 Notice of Proposed Construction or Alteration FAA Form 117-1 Notice of Progress or Alteration	Federal Aviation Administration	(14 CFR Part 77)
MASSACHUSETTS		
Wetlands Protection Act	Local Conservation Commissions; MDEP Div. of Wetlands & Waterways	310 CMR 10.00
Coastal Zone Management Program Federal Consistency Concurrence	EOEA Office of Coastal Zone Management	301 CMR 20.00
RHODE ISLAND		
Freshwater Wetlands Permit	RIDEM	RIGL Section 2-1-18 to 24
Coastal Resources Management Council Preliminary Determination &/or Permit	Coastal Resources Management Council	RIGL Section 46-23
CONNECTICUT		
Coastal Zone Federal Consistency Concurrence	ConnDEP Long Island Sound Program	CGS Sec. 22a-32 and 22a-29(3)

The Safe Drinking Water Act is commonly known as the Clean Water Act.
MDEP = Massachusetts Department of Environmental Protection; RIDEM = Rhode Island Department of Environmental Management; ConnDEP = Connecticut Department of Environmental Protection
Massachusetts Historic Commission; Rhode Island Historic Preservation Commission; Connecticut Historic Commission.

Endnotes

1. Personal communication with Stephen Gazillo, Morrison Knudsen Inc., 1993.

♦ List of Abbreviations

LIST OF ABBREVIATIONS

AAQS	Ambient Air Quality Standards
AC	Alternating current
ACEC	Area of Critical Environmental Concern
AHSR	Advanced high-speed rail
AML	Acute myelocytic leukemia
Amtrak	National Railroad Passenger Corporation
AREA	American Railway Engineering Association
ASA	Architecturally sensitive area
ATCS	Automated train signal and control
B&K	Brüel & Kjær
BMP	Best Management Practices
BOM	U.S. Bureau of Mines
BPA	Bonneville Power Administration
Btu	British thermal unit
CAAA	Clean Air Act Amendments of 1990
CA/T	Central Artery/Tunnel Project
CCITT	International Telephone and Telegraph Consultative Committee
CEQ	(President's) Council on Environmental Quality
CHC	Connecticut Historical Commission
CL&P	Connecticut Light and Power Company
CLL	Chronic lymphocytic leukemia
CNI	Cumulative Noise Index
CP	Cathodic protection
CO	Carbon monoxide
CONEG	Coalition of Northeastern Governors
ConnDEP	Connecticut Department of Environmental Protection
ConnDOT	Connecticut Department of Transportation
Conrail	Consolidated Rail Corporation
COSA	Connecticut Office of State Archaeology
CRMC	Coastal Resources Management Council
CWR	Continuous welded rail
CZMA	Coastal Zone Management Act
DAQC	Massachusetts Division of Air Quality Control

DAT	Digital audio tape
dB	Decibel (a vibration measurement)
dBA	A-weighted decibel (a noise measurement)
DC	Direct current
DEP	Massachusetts Department of Environmental Protection
DHS	Connecticut Department of Health Services
DMJM/Harris	Daniel, Mann, Johnson & Mendenhall/Frederic R. Harris, Inc.
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ELF	Extremely low frequency (electromagnetic field)
EMF	Electromagnetic field
EMI	Electromagnetic interference
EMTP	ElectroMagnetic Transients Program
ENF	Environmental Notification Form
EOEA	Massachusetts Executive Office of Environmental Affairs
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEIS/R	Final Environmental Impact Statement/Report
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FMVCP	Federal Motor Vehicle Emissions Control Program
FONSI	Finding of No Significant Impact
4R	Railroad Revitalization and Regulatory Reform Act of 1976
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HAER	Historic American Engineering Record
HAP	Hunt-Annaquatucket-Pettaquamscutt (Sole Source Aquifer Area)
HF	High frequency
HMMH	Harris Miller Miller & Hanson, Inc.
HP	Horsepower

HSGTA	High Speed Ground Transportation Act of 1965
HSR	High-speed rail
HVAC	Heating, ventilation, and air conditioning
HUD	U.S. Department of Housing and Urban Development
Hz	Hertz (cycles per second)
ICC	Interstate Commerce Commission
ICE	InterCity Express
I/M	Inspection and maintenance program
in/sec	Inches per second
INSERM	(French) Institute of Health and Medical Research
INT	Induction neutralizing transformer
kg/day	Kilograms per day
kHz	Kilohertz
kV	1,000 volts
kWh	Kilowatt-hours
L_{dn}	Day-night sound level
LEL	Limiting exposure level
L_{eq}	Equivalent noise level
L_{Fmax}	Maximum noise level
LISP	Long Island Sound Program
L_{max}	A-weighted maximum noise level
LNG	Liquid Natural Gas
LOS	Level of service
LRC	Light Rapid Comfortable
mA	Milliampere
Maglev	Magnetic levitation vehicle
MARC	Maryland Rail Corporation
MAS	Maximum allowable speed
Massport	Massachusetts Port Authority
MBTA	Massachusetts Bay Transportation Authority
MEPA	Massachusetts Environmental Policy Act
mG	Milligauss
$\mu g/m^3$	Micrograms per cubic meter
MHC	Massachusetts Historic Commission
MHD	Massachusetts Highway Department

MHW	Mean high water
MK	Morrison Knudsen Corporation
MLW	Mean low water
MOA	Memorandum of Agreement
MP	Milepost
mph	Miles per hour
MTA	Massachusetts Turnpike Authority
mV	Millivolt
Mw	Megawatt
MwH	Megawatt hour
MWRA	Massachusetts Water Resources Authority
NCI	National Cancer Institute
ND	Negative Declaration (now FONSI)
NEC	Northeast Corridor
NECIP	Northeast Corridor Improvement Project
NECTP	Northeast Corridor Transportation Plan
NEPA	National Environmental Policy Act of 1969
NEPOOL	New England Power Pool
NESC	National Electric Safety Code
NEU	Northeast Utility Corporation
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act of 1966
NHRIP	Northeast High-Speed Rail Improvement Project
NIST	U.S. National Institute of Standards and Technology
NMFS	National Marine Fisheries Service
NMI	National Maglev Initiative
NOI	Notice of Intent
NO_x	Oxides of nitrogen
NR	National Register of Historic Places
NRPB	(British) National Radiation Protection Board
NWI	National Wetlands Inventory
OCS	Overhead catenary system
Ω-m	Ohm
OHSGT	Office of High Speed Ground Transportation
OR	Odds ration (of exposure to EMF)

ORAU	Oak Ridge Associated Universities
PA	Programmatic agreement
P&W	Providence & Worcester Railroad Company
PEIS	Programmatic Environmental Impact Statement
PM10	Particulate matter smaller than or equal to 10 microns
ppm	Parts per million
PS	Paralleling station
RIDEM	Rhode Island Department of Environmental Management
RIDOT	Rhode Island Department of Transportation
RIHPC	Rhode Island Historic Preservation Commission
rms	Root-mean-square
ROD	Record of Decision
ROW	Right-of-way
RPSA	Rail Passenger Service Act
RTG	Rame Turbine à Gaz
RTL	Rhor Turboliner
SCCRWA	South Central Connecticut Regional Water Authority
SCS	Soil Conservation Service (of U.S. Department of Agriculture)
SEL	Sound exposure level
SEPTA	Southeastern Pennsylvania Transportation Authority
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SNCF	Societe Nationale Chemin de Fer Francaise (French National Railway)
SNET	Southern New England Telephone Company
SRB	Single Residence B Zone
SS	Substation
SWCP	Southwest Corridor Project
SwS	Switching station
TACV	Tracked air cushion vehicle
TCLP	Toxicity Characteristic Leaching Procedure
TGV	Train Grand Vitesse (French high-speed train)
TPH	Total petroleum hydrocarbon
3R	Regional Rail Reorganization Act of 1973
TRB	Transportation Research Board
TSC	Volpe National Transportation System Center

TSM/TDM	Transportation System Measures/Transportation Demand Measures
UHF	Ultra high frequency
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VC	Visual complexity
V_{dB}	Ground vibration velocity level
VHF	Very high frequency
VMC	Visual modification classification
VMT	Vehicle miles of travel
VOC	Volatile organic compound
Vrms	Effective voltage
VSR	Visually sensitive receptor
WF	Wide flange

♦ Glossary of Terms

GLOSSARY

Above-grade construction: construction that takes place above the surface of the ground

Abutters: owners and/or managers and tenants of property adjacent to the project ROW

Airline Route: a rail corridor between New Haven and Boston originally providing all-rail service with the lowest mileage of the three routes; but long since abandoned because of numerous curves, unfavorable grades, and a large number of highway grade crossings; the route was named for the Airline Junction, a now disused station

Alignment: a railroad's horizontal location as described by curves and tangents

Amtrak: the National Railroad Passenger Corporation, responsible for providing intercity rail passenger service in the U.S.; the project proponent

Anadromous fish: adult ocean fish that migrate to spawn in fresh water

Archaeological finds: examples include bones, pottery, foundations of buildings and wharves, which can give us some knowledge of the daily life, architecture, and economics of the past; found below grade

Architecturally sensitive area (ASA): an area in which a proposed facility could be significantly out of scale in height or mass, or out of character in style or substance, from the existing structures of the neighborhood

At-grade construction: construction that takes place on a level with the ground surface

Attainment, attainment status: signifies that an area meets state and/or Federal air quality standards; non-attainment status signifies that an area does not meet these standards and requires the political unit(s) within the area to develop and implement measures to lower pollution emitted within the area, and move the area into attainment status

A-weighted decibel (dBA): a measurement unit that adjusts measured sound pressure levels at different frequencies to conform to the frequency response of the human ear

Backfill: material such as sand, gravel, or crushed stone used to fill the space between an excavation and the exterior of a structure or a trench

Background: ambient conditions

Bascule bridge: a type of drawbridge in which one end is counterbalanced by the other on the principle of the fulcrum and lever

Below-grade construction: construction that takes place below the surface of the ground

British thermal unit (Btu): the amount of energy necessary to raise 1 pound of water 1 degree Fahrenheit, at or near 39.2 degrees

Case: control study

Catenary: an overhead power distribution system to supply electric power to locomotives; power is collected by the locomotives through a pantograph which is in constant contact with the power wire

Clean Air Act Amendments: Federal regulations of 1991 mandating the use of technologies that will result in improved air quality

Consist: the number of units per train, including the locomotive

Criteria pollutants: pollutants used by Federal and state agencies in determining air quality and public health standards

Conrail: Consolidated Rail Corporation, responsible for rail freight service in Massachusetts

Crosstie: a tie: one of the transverse supports to which railroad rails are fastened to keep them in line

Cut: an open excavation for carrying a road, railway, pipeline, or canal below ground level in the open

Cut-and-cover: a method of tunnel construction which involves digging a trench, and covering it with decking to allow vehicular and pedestrian movement above while continuing with construction below

Decibel (dB): a measure of sound level

Design year (2010): the future year for which ridership/trainset volumes projected are accommodated in the project design

Dust control agent: water or other chemical sprayed on surface of road or soil to prevent/reduce suspension of particulate

Embayment: a bay or indentation along the shoreline

Emissions factor: a number representing the mass of a pollutant per unit of fuel burned or the mass of a pollutant produced per unit of a process activity, i.e., number of pounds of particulate matter produced for every ton of coal burned in a power generating facility, etc.; EPA produces a compendium of emissions factors for use in air quality analyses

Environmental Impact Statement (EIS): a document detailing the probable impacts (environmental, sociological, economic, visual, etc.) of a proposed project in the planning phase

Equivalent Noise Level (L_{eq}): the equivalent steady noise level which in a given period of time contains the same noise energy as time-varying noise (i.e., environmental noise that fluctuates from moment to moment) during the same period

Federal Consistency Concurrence: approval required to show that a proposed project is consistent with Massachusetts Coastal Zone Management Program regulations and policies

Federal Highway Administration: an agency of the U.S. Department of Transportation responsible for setting and monitoring standards of highway construction, use, and regulatory settings

Federal Railroad Administration: an operating administration within the U.S. DOT vested with the primary responsibility for national railroad policies and programs

Floodplain: (1) level land that may be submerged by floodwaters; (2) a stream built up by stream deposition

Grade: the degree of inclination of a road or a slope

Grade crossing: a crossing of highways, railroad tracks, or pedestrian walks, or combination of these on the same level

Groundwater: water in the part of the ground that is wholly saturated

Habitat: the place or type of site where a plant or animal naturally or normally lives and grows

HABS: Historic American Building Survey, established in 1933 to document the nation's architectural resources

HAER: Historic American Engineering Record, established in 1969 to document the nation's engineering resources

Hertz (Hz): a unit of frequency which corresponds to 1 cycle per second

Hourly equivalent noise level [L_{eq}(h)]: a measure of noise energy averaged over an hour, expressed in dBA

Hydrocarbon (HC): an organic compound containing only carbon and hydrogen, and often occurring in petroleum, natural gas, coal, and bitumens

I&M Program: an inspection and maintenance program requiring annual inspections of automobiles and light-duty trucks to determine if carbon monoxide (CO) and hydrocarbon (HC) amounts coming from their exhaust systems are below emission standards

Inland Route: a route providing passenger service between New York and Boston via New Haven-Springfield-Boston; ownership of trackage is divided, largely between Amtrak and Conrail; considered as an possible alternative to the Shore Line Route

Intersection Level of Service: see **Level of Service**

Jersey barrier: a protective boundary or roadway divider made of concrete

Level of Service (LOS): a measure of the quality of traffic flow, ranging from A to F, where A is free-flowing traffic with little or no delay and F is slow-moving traffic with delays

Memorandum of Agreement (MOA): under Section 106 of the National Historic Preservation Act of 1966, the product of consulting agency officials and/or others that contains stipulations specifying project avoidance or mitigation of adverse effects or accepting such effects

Micrograms per cubic meter ($\mu g/m^3$): a unit for expressing the concentration of a pollutant in the atmosphere

Micron (μm): a unit of length equal to 1 millionth of a meter; also called micrometer

Milligauss: a standard unit of measure for expressing electromagnetic field intensity

Mitigation: planning of design and/or construction to overcome or avoid adverse impacts

Mode, Mode Share: an abbreviation of "mode of transport," e.g., a car, a bus, a water ferry; "Mode Share" is the percentage of total person-trips using the mode in question; "person-trip" is simply a trip with an origin and a destination made by a person, e.g., a bus mode share of 20 percent means that 20 percent of all people arriving and departing a particular location do so on a bus

National Ambient Air Quality Standards (NAAQS): a set of health standards for public outdoor spaces anywhere and everywhere in the U.S., mandated by the Federal Clean Air Act; there are a number of areas, such as indoor spaces, which are not covered by NAAQS

National Register (NR): National Register of Historic Places, the official list created by the enactment of the National Historic Preservation Act of 1966 that officially documents designated historic properties located in the U.S.

No-Build Alternative: retention of the existing dual track system between Boston and Washington, i.e., maintaining the diesel-electric operation with a change of locomotives at New Haven to accommodate the use of non-electric service from New Haven to Boston

Nonattainment, nonattainment status: see **Attainment, Attainment status**

Northeast Corridor (NEC): the Washington-New York-New Haven-Providence-Boston railroad route, the New Haven-Providence-Boston Shore Line Route, and the New Haven-Hartford-Springfield-Boston Inland Route

Northeast Corridor Improvement Project: FRA's project for the upgrading of the NEC, including the upgrade of facilities, and increase in speed and safety on the New Haven to Boston segment

One-hundred year storm: a storm generally with rainfall intensity expected, or recorded as occurring, about once every 100 years

Open cut: a method of excavation in which the work area is open at the surface (used to distinguish from cut-and-cover or tunneling work)

Ozone (O_3): a form of oxygen, O_3, having three atoms to the molecule, with a peculiar odor suggesting that of weak chlorine, produced when an electric spark is passed through air or oxygen

Pantograph: a collapsible frame extending from the locomotive roof to collect electric power from the overhead catenary system

PM10: particulate matter smaller than 10 microns in size (1 micron = 1 millionth of a meter)

Polychlorinated biphenyl (PCB): any of several compounds that are produced by replacing hydrogen atoms in biphenyl with chlorine, have various industrial applications, and are poisonous environmental pollutants which tend to accumulate in animal tissue

Proposed Action: the proposed electrification of the NEC between New Haven and Boston

Providence & Worcester Railroad Company: freight rail carrier along the NEC that services the states of Connecticut and Rhode Island

Right-of-way: the strip of land on which a railroad track is built; the term generally refers to intercity main line tracks, but can also apply to branch lines and sidings

Section 4(f) Evaluation: Section 4(f) of the Department of Transportation Act of 1966: prohibits use of parkland and historic or archaeological resources unless there is no "feasible or prudent alternative"

Shore Line Route: a segment of the NEC, the route over which the New Haven to Boston railroad runs, and the route proposed for electrification in this FEIS/R

Storm drain: a sewer or pipe through which stormwater is conveyed

Swing bridge: a drawbridge with two sections that turn in place, as on a pivot

Underpinning: a permanent or temporary support system to provide strength and reinforcement to a building or structure to prevent any settlement caused by adjacent construction

Utility tie-in: the transmission line to a substation, where electricity is delivered from a local utility company's transmissions network via a tie-in that consists of either overhead or underground wires connecting the two systems

Vehicle Miles of Travel (VMT): a measure of traffic impact obtained by multiplying the total number of vehicles within a given area by the number of miles they travel on streets and highways in the defined area; it is also an input to air quality impact methodology

Viaduct: a bridge carrying a roadway over an obstruction, such as a river or another section of highway, or connecting a surface road with an elevated roadway

Visually sensitive receptor (VSR): a residence, historic structure or district, and park, roadway, or other public location with existing views or vistas of the waterfront or other scenic area

Wetlands: those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted to life in saturated soil conditions

Wetlands Protection Act (Massachusetts): under the provisions of the Wetlands Protection Act M.G.L. c. 131 s. 40 ("the Act") no person may remove, fill, dredge, or alter certain resource areas without first filing a Notice Of Intent and obtaining an Order of Conditions; the Act requires that any order so issued must contain conditions sufficient to preserve and promote the following public interests: the protection of public or private water supply and groundwater supply, the enhancement of flood control and storm damage prevention, the prevention of pollution, and the protection of fisheries and land containing shellfish

♦ Appendix A

Electrification Facilities and Bridge Modifications

NOTES:

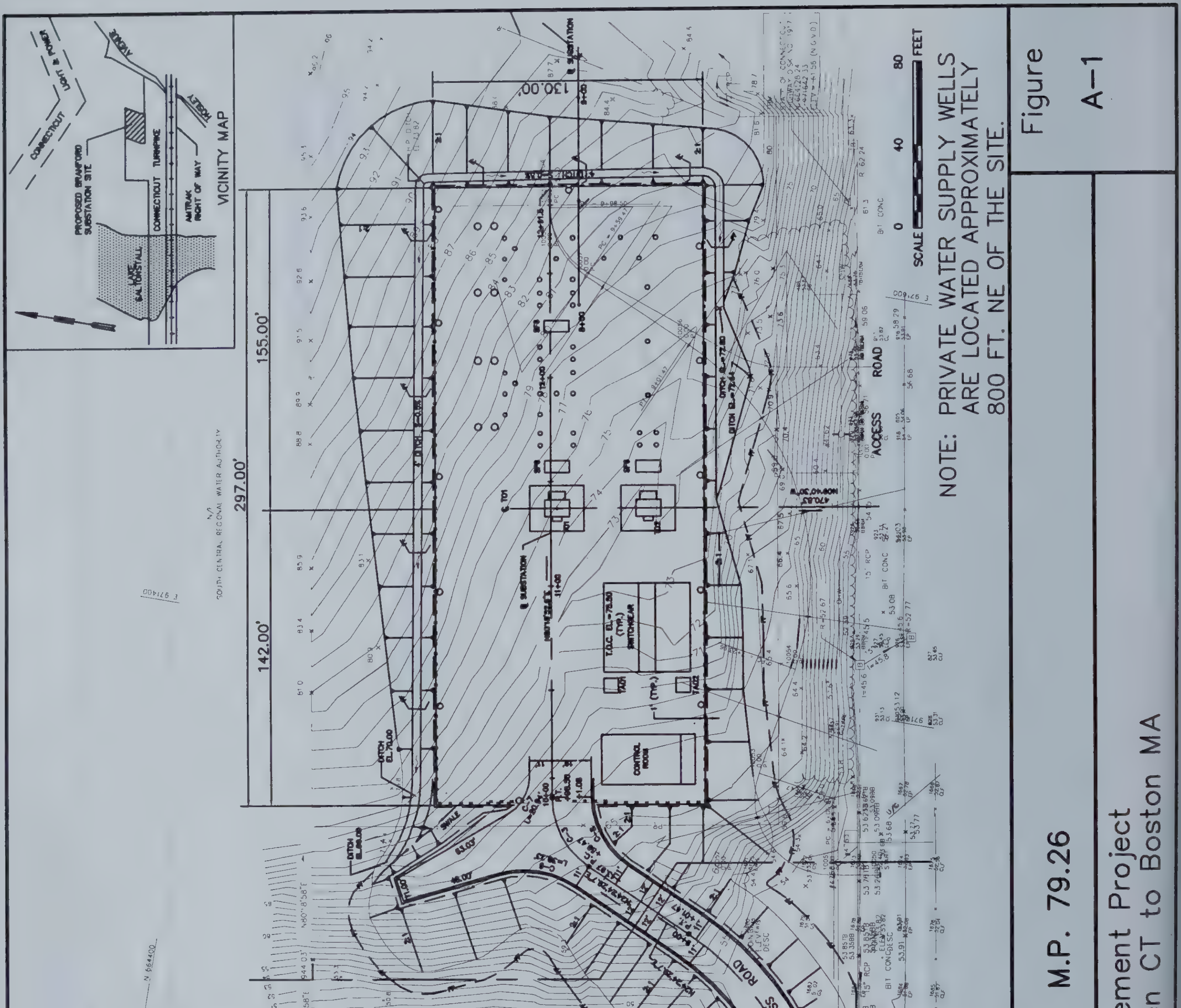
1. THE MAPPING FOR THIS PLAN ORIGINATED FROM AERIAL PHOTOGRAPHS TAKEN IN APRIL 1992 BY CHAS H. SELLS INC. BASED IN CHARLTON, MASSACHUSETTS.

LEGEND

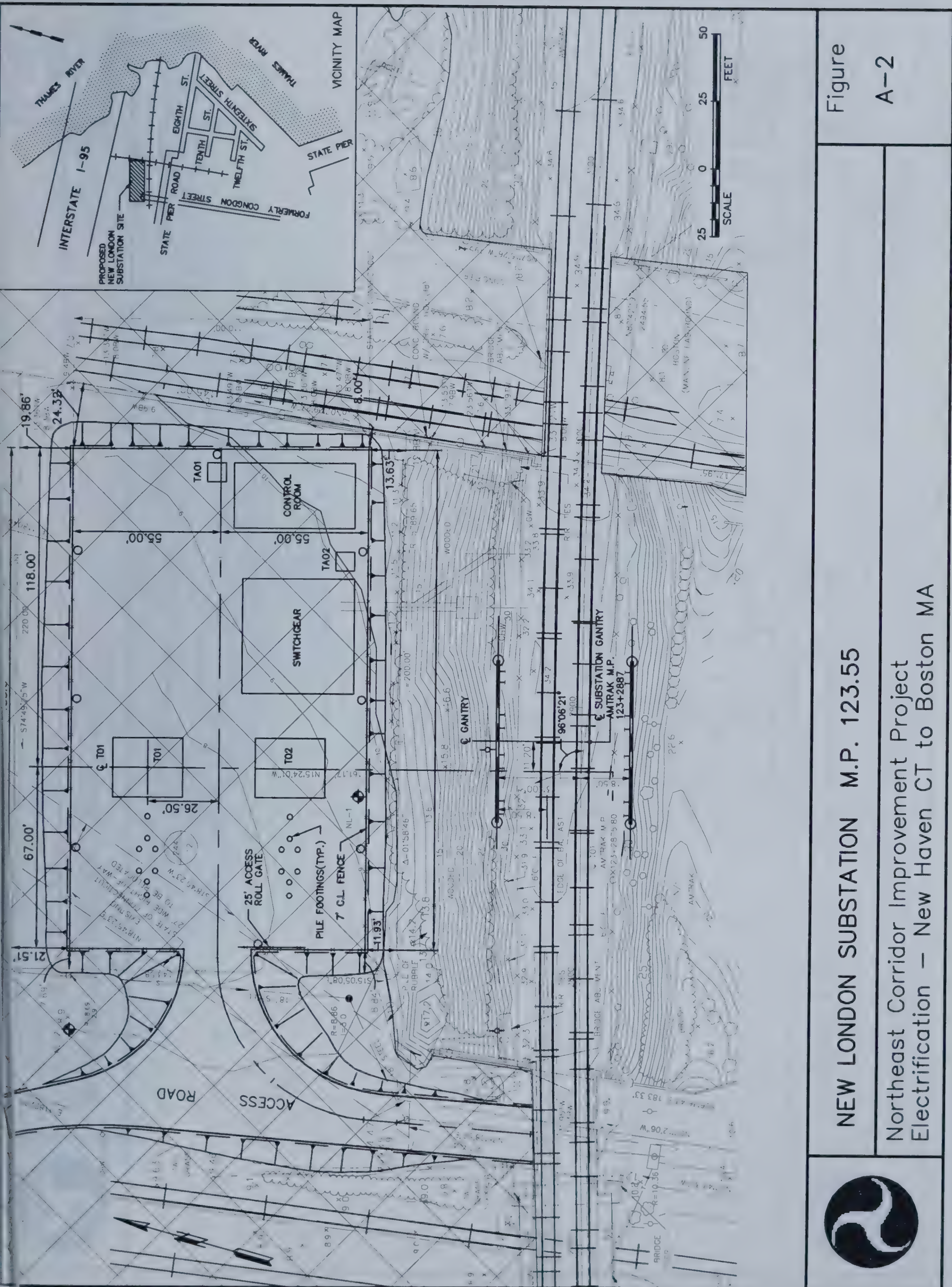
X	SPOT ELEVATION LOCATION
100 x 00	ELEVATION
	CENTERLINE FOR ROAD AND RAILROAD TRACK
	UTILITY EASEMENT BOUNDARY
PL	PROPERTY LINE
PPL	PROPOSED PROPERTY LINE
	RAILROAD TRACKS
M.P.	MILEPOST
#	WETLAND EDGE
	100 YEAR FLOODPLAIN
A.C.E.C.	AREA OF CRITICAL ENVIRONMENTAL CONCERN

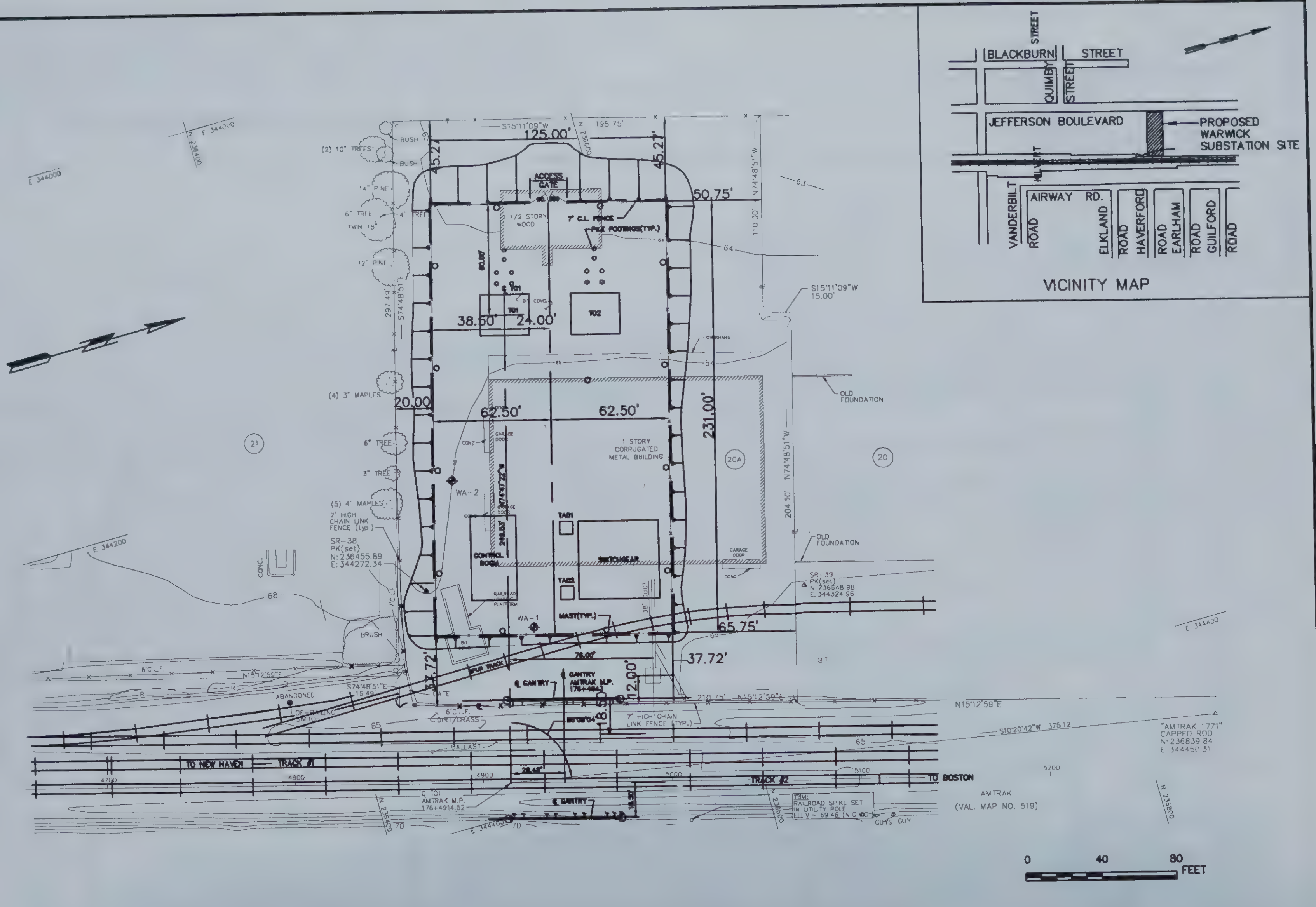
NOTES & LEGEND

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA



VICINITY MAP
PROPOSED BRANFORD SUBSTATION SITE
LAKE SALTONSTALL
CONNECTICUT TURNPIKE
AMTRAK RIGHT OF WAY
SOUTH CENTRAL REGIONAL WATER AUTHORITY
297.00'
155.00'
142.00'
130.00'
CONTROL ROOM
SWITCHGEAR
EDGE OF WETLAND
SUBSTATION ACCESS ROAD
SCALE 0 40 80 FEET
NOTE: PRIVATE WATER SUPPLY WELLS ARE LOCATED APPROXIMATELY 800 FT. NE OF THE SITE.
BRANFORD SUBSTATION M.P. 79.26
Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA
Figure A-1

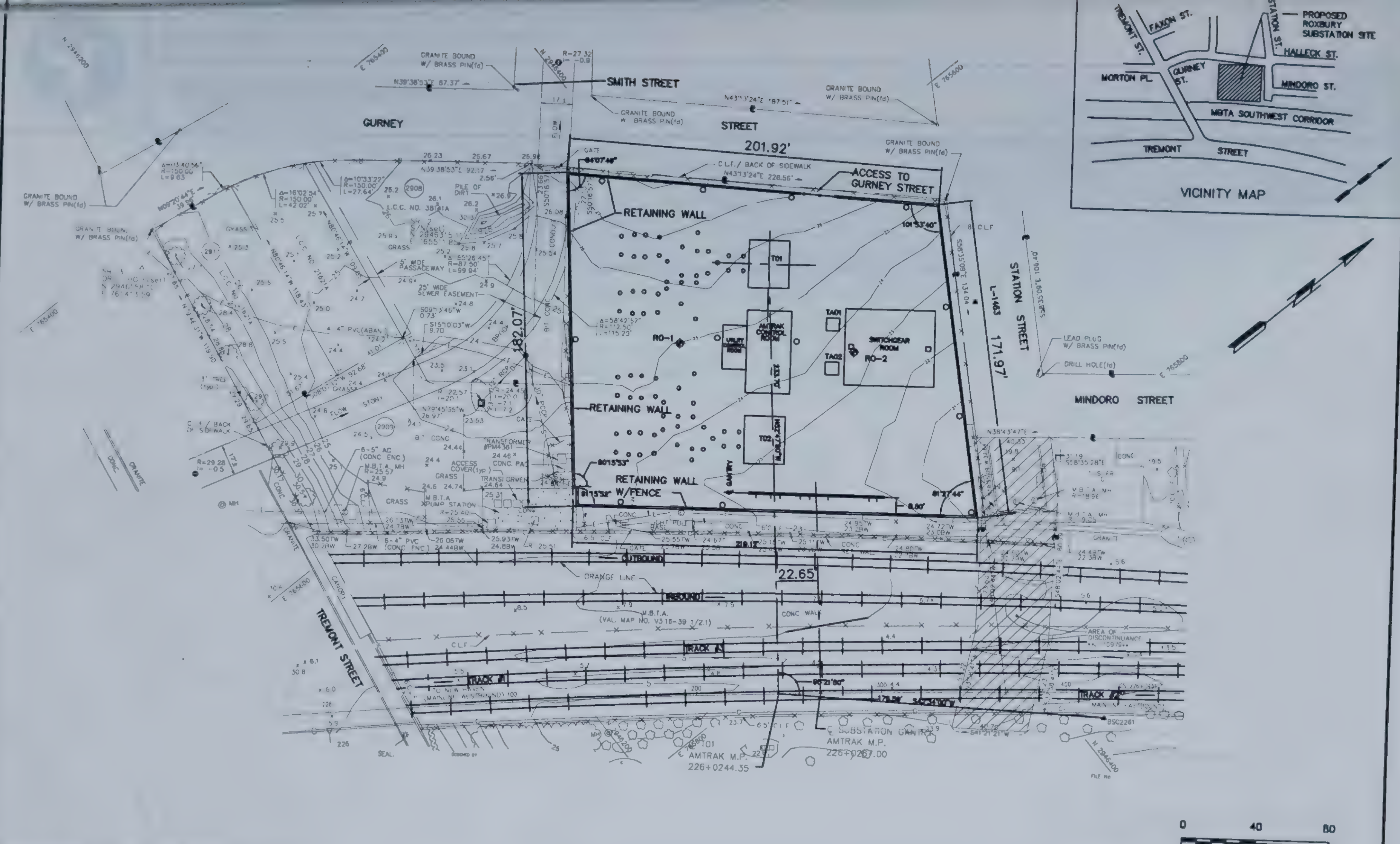

NEW LONDON SUBSTATION M.P. 123.55
Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA
Figure
A–2
VICINITY MAP
THAMES RIVER
INTERSTATE I–95
PROPOSED NEW LONDON SUBSTATION SITE
STATE PIER ROAD
FORMERLY CONGDON STREET
EIGHTH ST.
TENTH ST.
TWELFTH ST.
SIXTEENTH STREET
STATE PIER
SCALE
FEET
CONTROL ROOM
SWITCHGEAR
TA01
TA02
T01
T02
℄ T01
℄ GANTRY
℄ SUBSTATION GANTRY
AMTRAK M.P.
123+2887
25' ACCESS ROLL GATE
PILE FOOTINGS(TYP.)
7' C.L. FENCE
ACCESS ROAD
118.00'
67.00'
55.00'
26.50'
21.51'
19.86'
24.32'
13.63'
11.93'
8.00'
11.20'
96°06'21"



WARWICK SUBSTATION M.P. 176.91

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

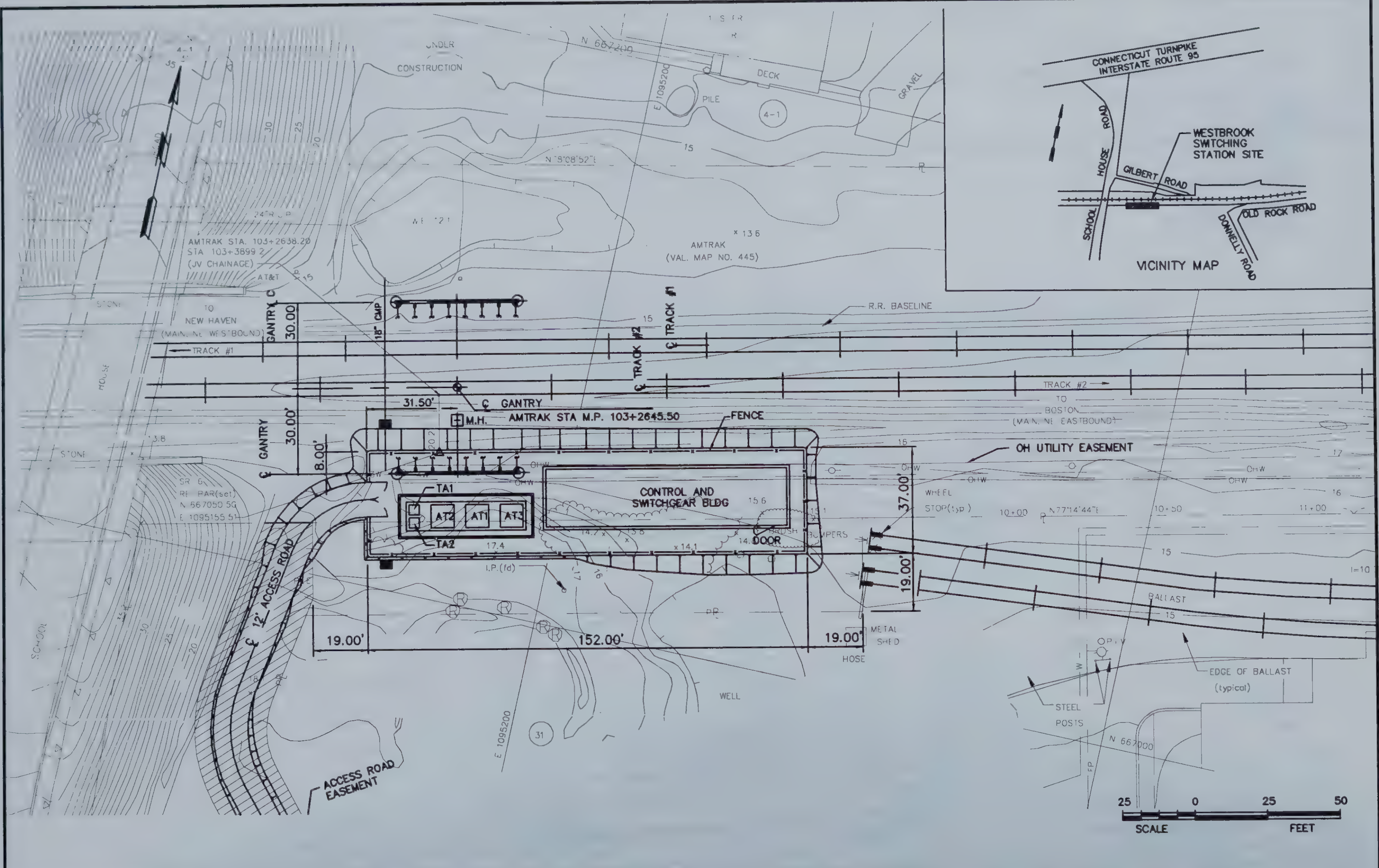
Figure A–3



ROXBURY CROSSING SUBSTATION M.P. 226.02

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

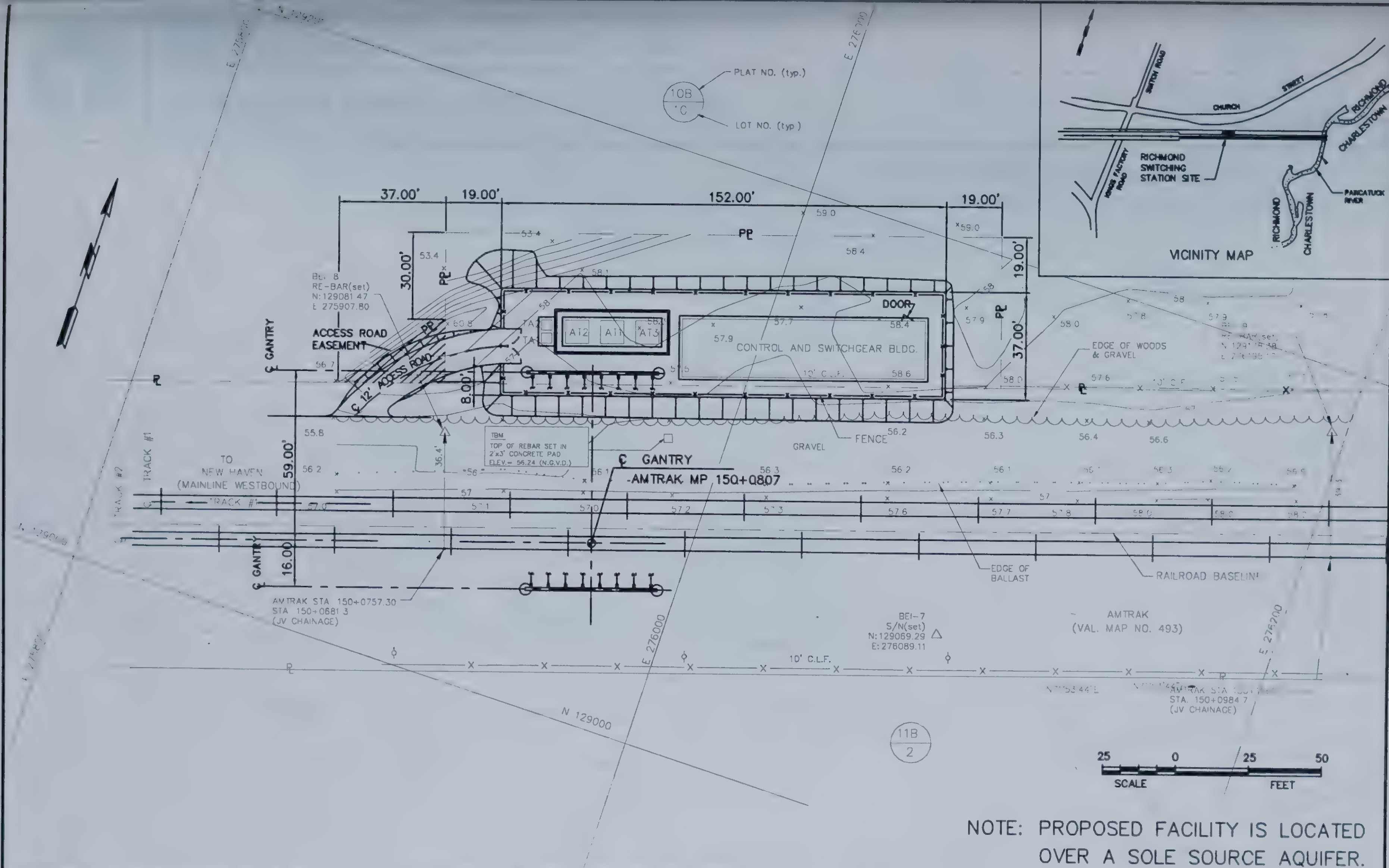
Figure A–4



WESTBROOK SWITCHING STATION M.P. 103.74

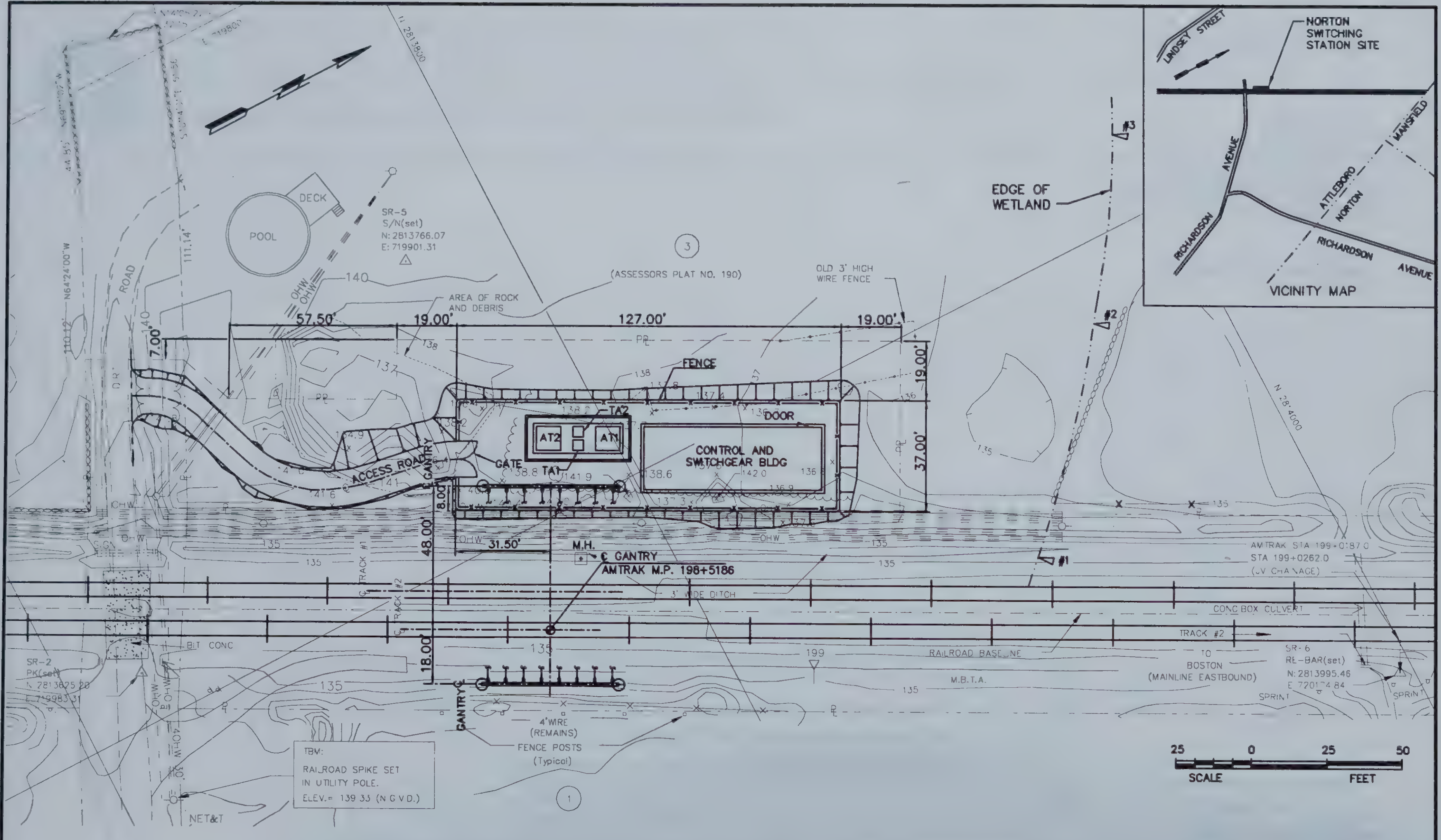
Northeast Corridor Improvement Project
Electrification — New Haven CT to Boston MA

Figure A–5



NOTE: PROPOSED FACILITY IS LOCATED OVER A SOLE SOURCE AQUIFER.

	RICHMOND SWITCHING STATION M.P. 150.15	Figure A-6
	Northeast Corridor Improvement Project Electrification – New Haven CT to Boston MA	

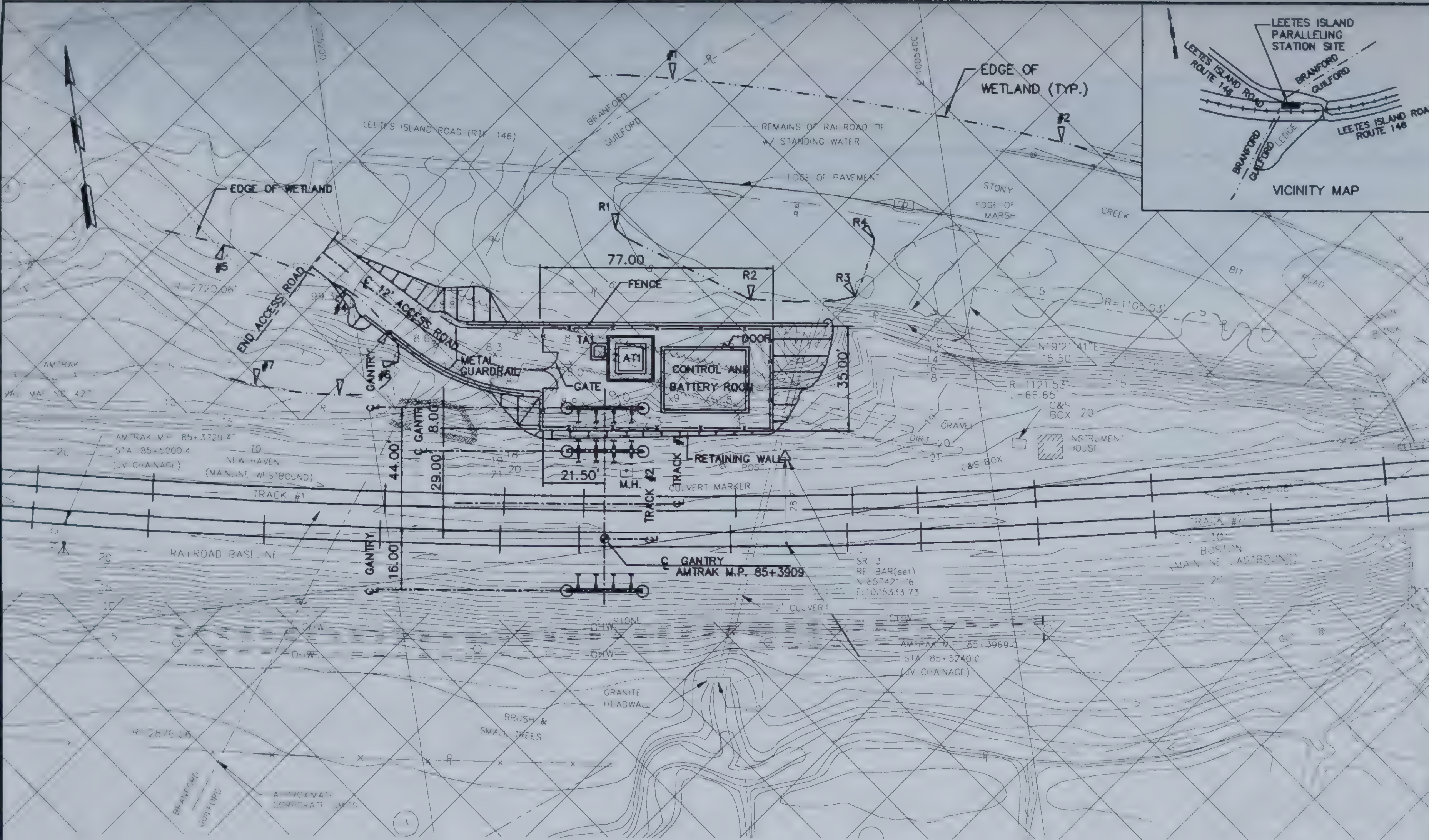


NOTE: PROPOSED FACILITY IS LOCATED WITHIN THE BUNGAY RIVER WATER RESOURCE DISTRICT.

NORTON SWITCHING STATION M.P. 198.99

Northeast Corridor Improvement Project
Electrification — New Haven CT to Boston MA

Figure A–7



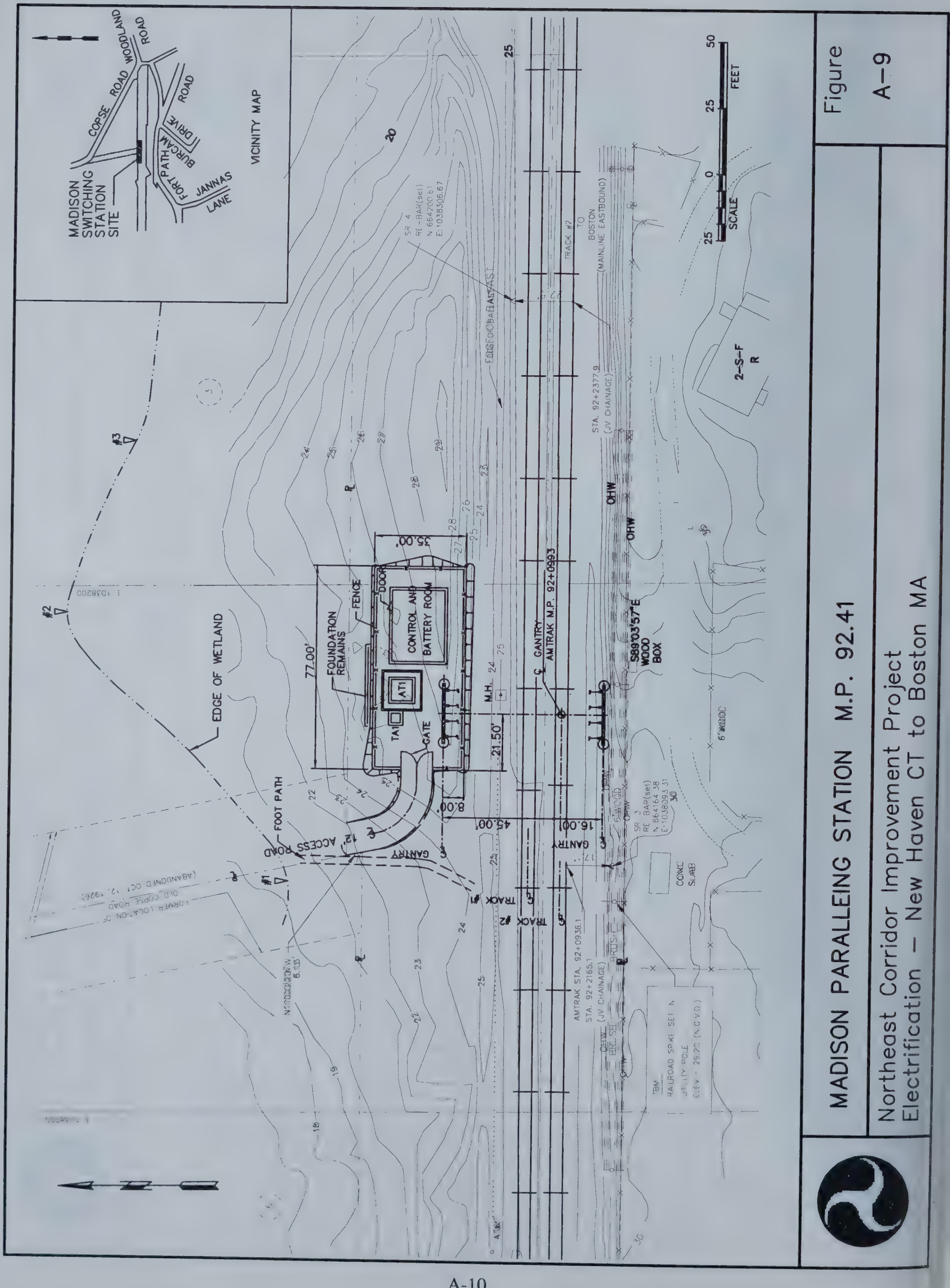
NOTE: PROPOSED FACILITY IS LOCATED IN A COASTAL FLOOD HAZARD AREA.

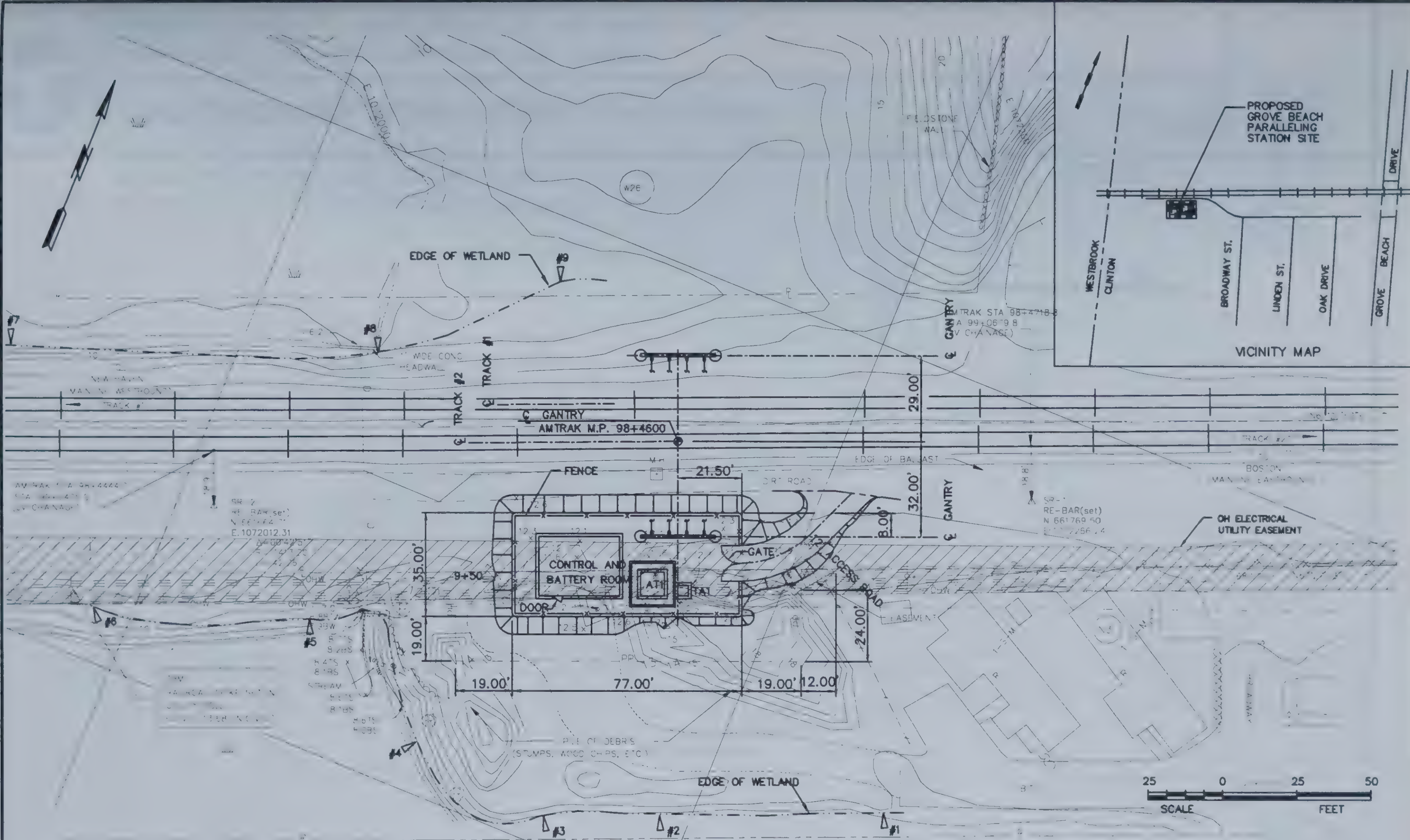
SCALE 25 0 25 50 FEET

LEETES ISLAND PARALLELING STATION M.P. 85.99

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–8


MADISON PARALLEING STATION M.P. 92.41
Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA
Figure
A–9
VICINITY MAP
MADISON SWITCHING STATION SITE
COPSE ROAD
WOODLAND ROAD
BURCAM DRIVE
ROAD
FORT PATH
JANNAS LANE
EDGE OF WETLAND
FOOT PATH
12' ACCESS ROAD
GANTRY
FOUNDATION REMAINS
FENCE
DOOR
CONTROL AND BATTERY ROOM
GATE
AT1
TA1
77.00'
35.00'
21.50'
8.00'
45.00'
16.00'
M.H.
℄ GANTRY AMTRAK M.P. 92+0993
S89°03'57"E
WOOD BOX
℄ TRACK #1
℄ TRACK #2
TRACK #2 TO BOSTON (MAINLINE EASTBOUND)
STA. 92+2377.9 (JV CHAINAGE)
AMTRAK STA. 92+0936.1
STA. 92+2165.1 (JV CHAINAGE)
SR 4 RE-BAR(set) N 664700.61 E:1038306.67
SR 3 RE-BAR(set) N 664164.38 E:1038093.31
OHW
6' WOOD
CONC SLAB
2-S-F R
BRUSH
TBM RAILROAD SPIKE SET IN UTILITY POLE ELEV = 29.29 (N.G.V.D.)
FORMER LOCATION OF OLD COPSE ROAD (ABANDONED OCT '12, 1926)
E 1038200
#1
#2
#3
SCALE
0
25
50
FEET

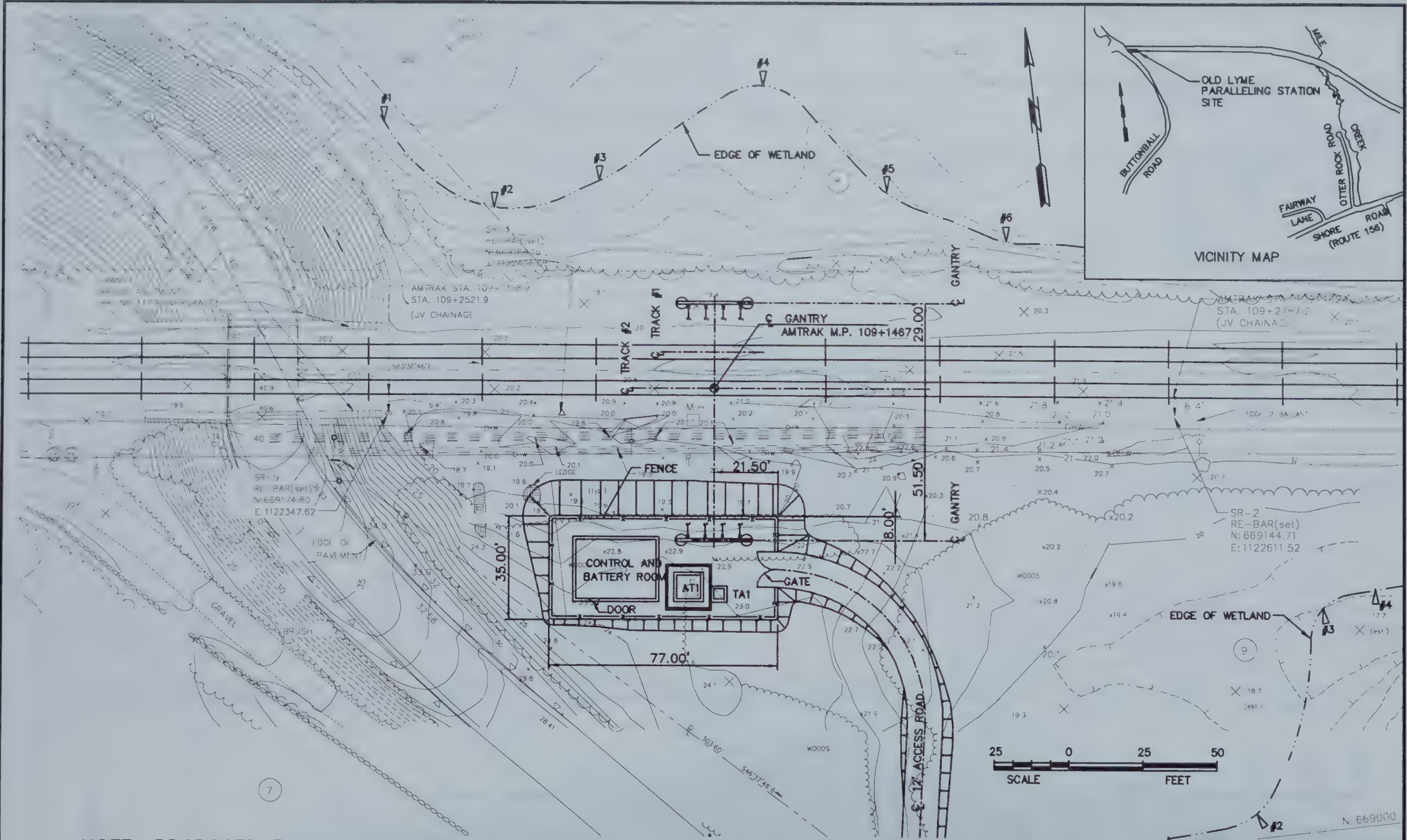


NOTE: PROPOSED FACILITY SITE IS DESIGNATED SHORELANDS WITHIN THE COASTAL ZONE.

GROVE BEACH PARALLELING STATION M.P. 99.11

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–10

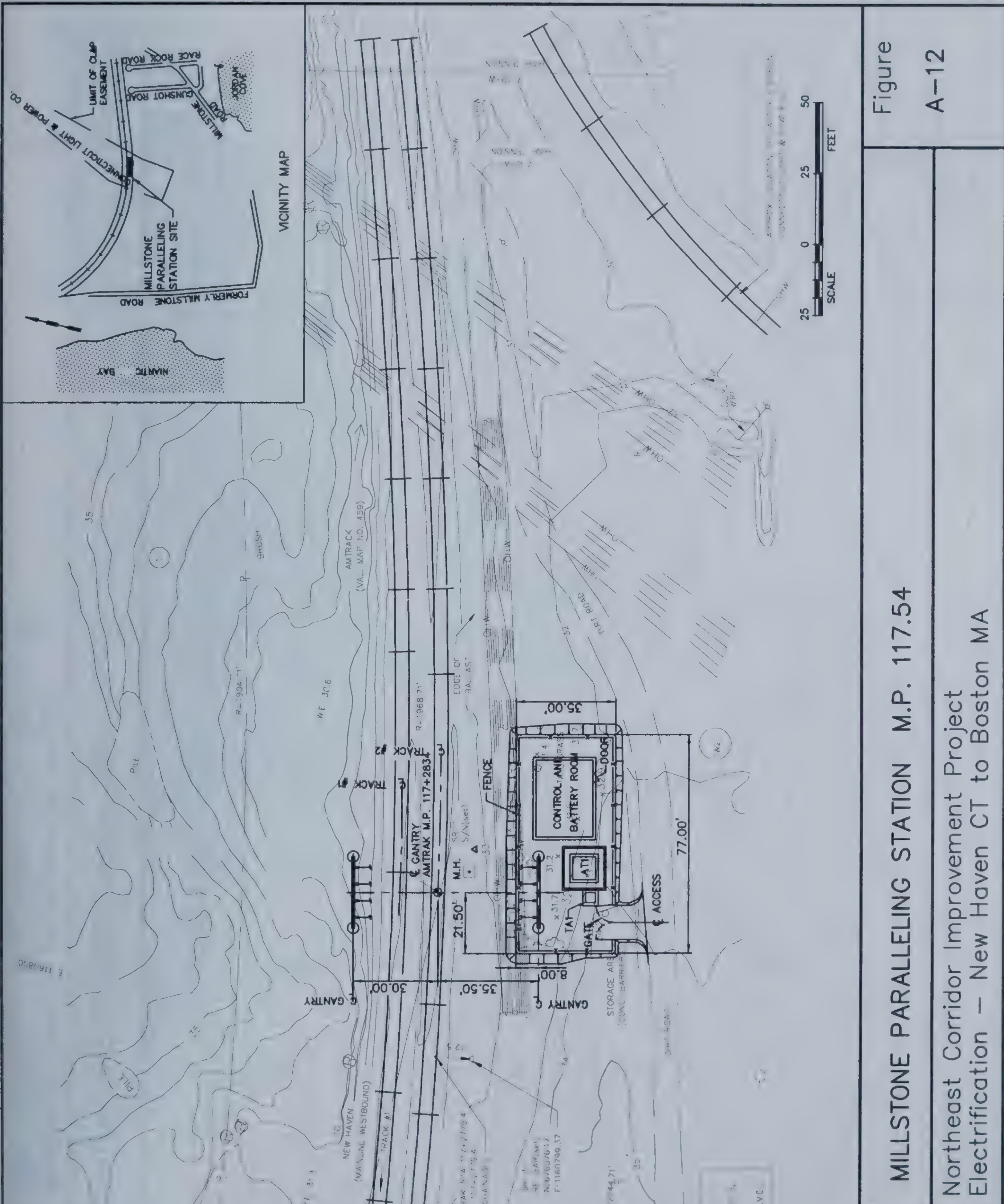


NOTE: PROPOSED FACILITY SITE IS DESIGNATED SHORELANDS WITHIN THE COASTAL ZONE.

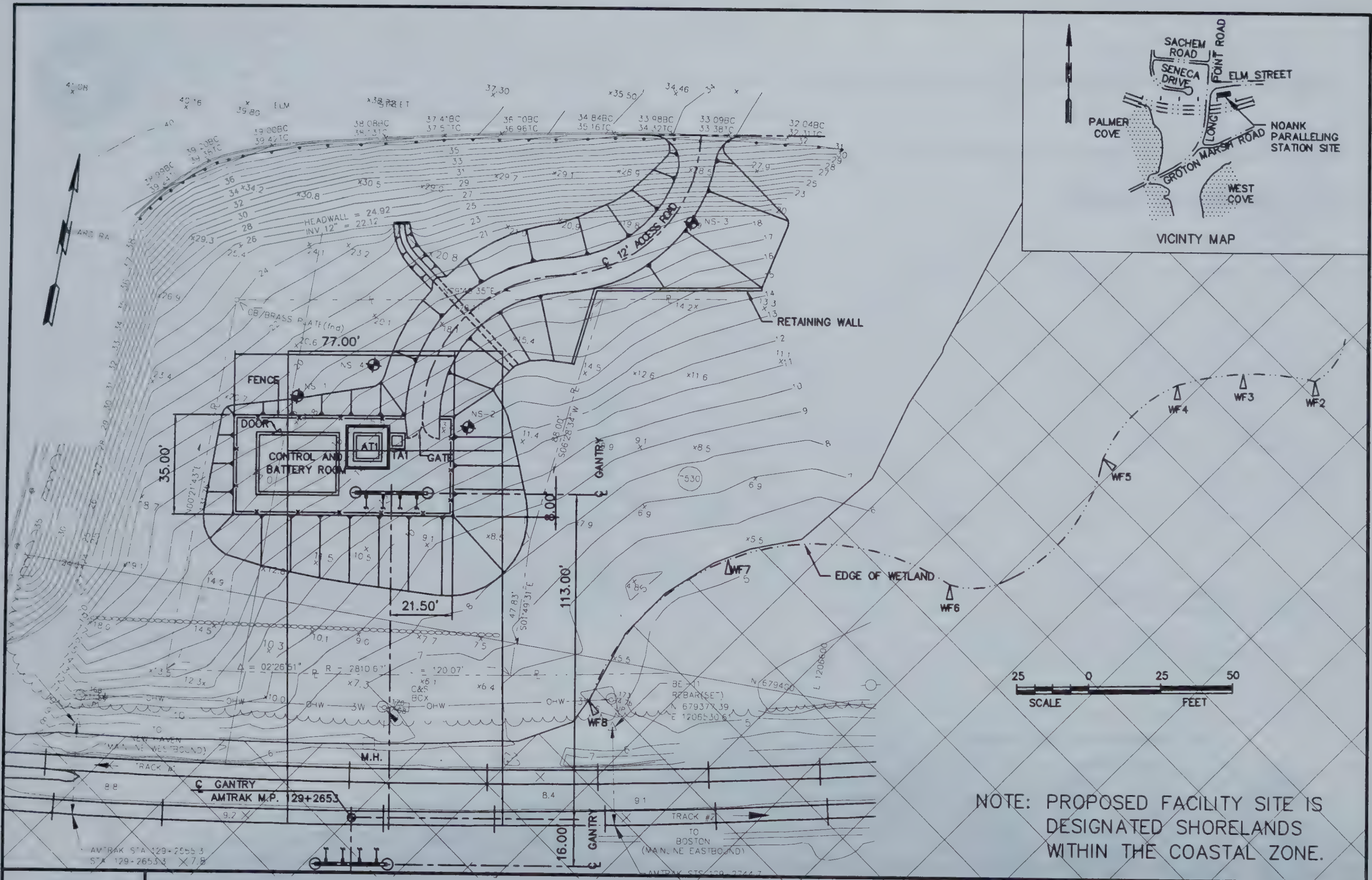
OLD LYME PARALLELING STATION M.P. 109.50

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–11



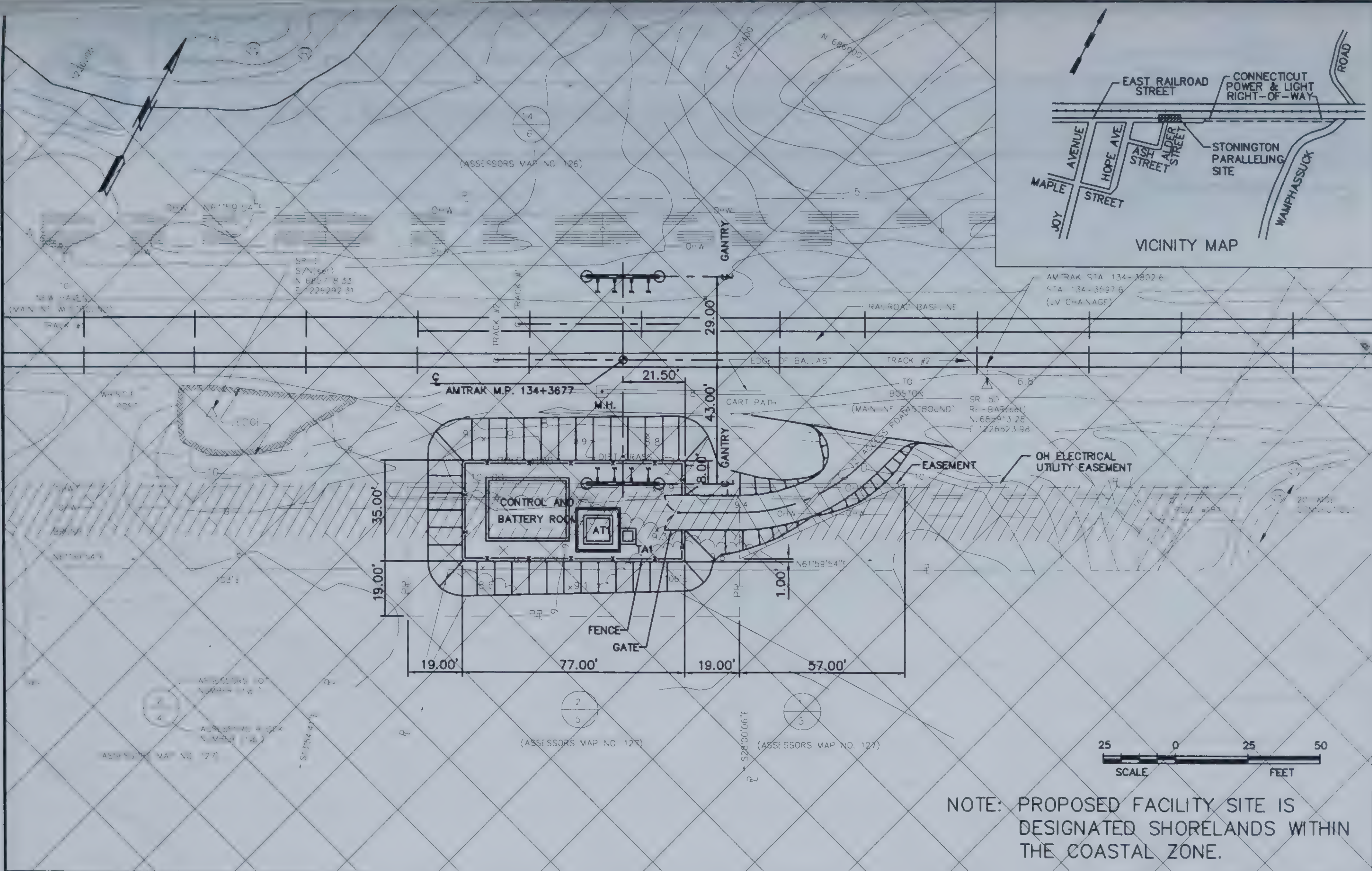
MILLSTONE PARALLELING STATION M.P. 117.54
Northeast Corridor Improvement Project
Electrification — New Haven CT to Boston MA
Figure
A-12
VICINITY MAP
MILLSTONE PARALLELING STATION SITE
FORMERLY MILLSTONE ROAD
NIANTIC BAY
LIMIT OF CL&P EASEMENT
CONNECTICUT LIGHT & POWER CO.
RACE ROCK ROAD
GUNSHOT ROAD
MILLSTONE ROAD
JORDAN COVE
CONTROL AND BATTERY ROOM
FENCE
GATE
ACCESS
GANTRY
TRACK #1
TRACK #2
AMTRAK M.P. 117+2834
AMTRACK (VAL. MAP NO. 459)
35.00'
77.00'
21.50'
30.00'
35.50'
8.00'
SCALE
FEET
25
0
25
50



NOANK PARALLELING STATION M.P. 129.52

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

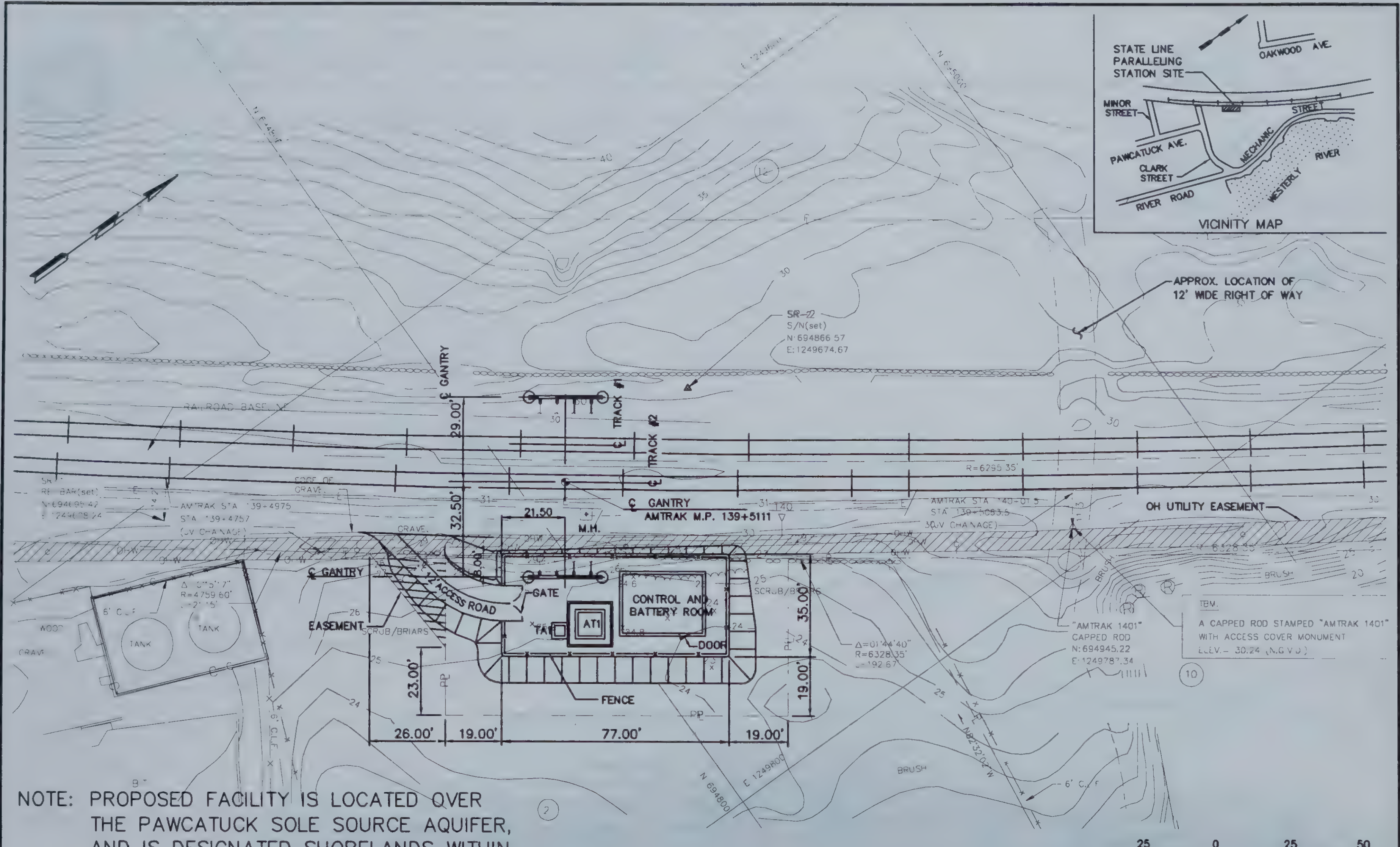
Figure A–13



STONINGTON PARALLELING STATION M.P. 134.65

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–14

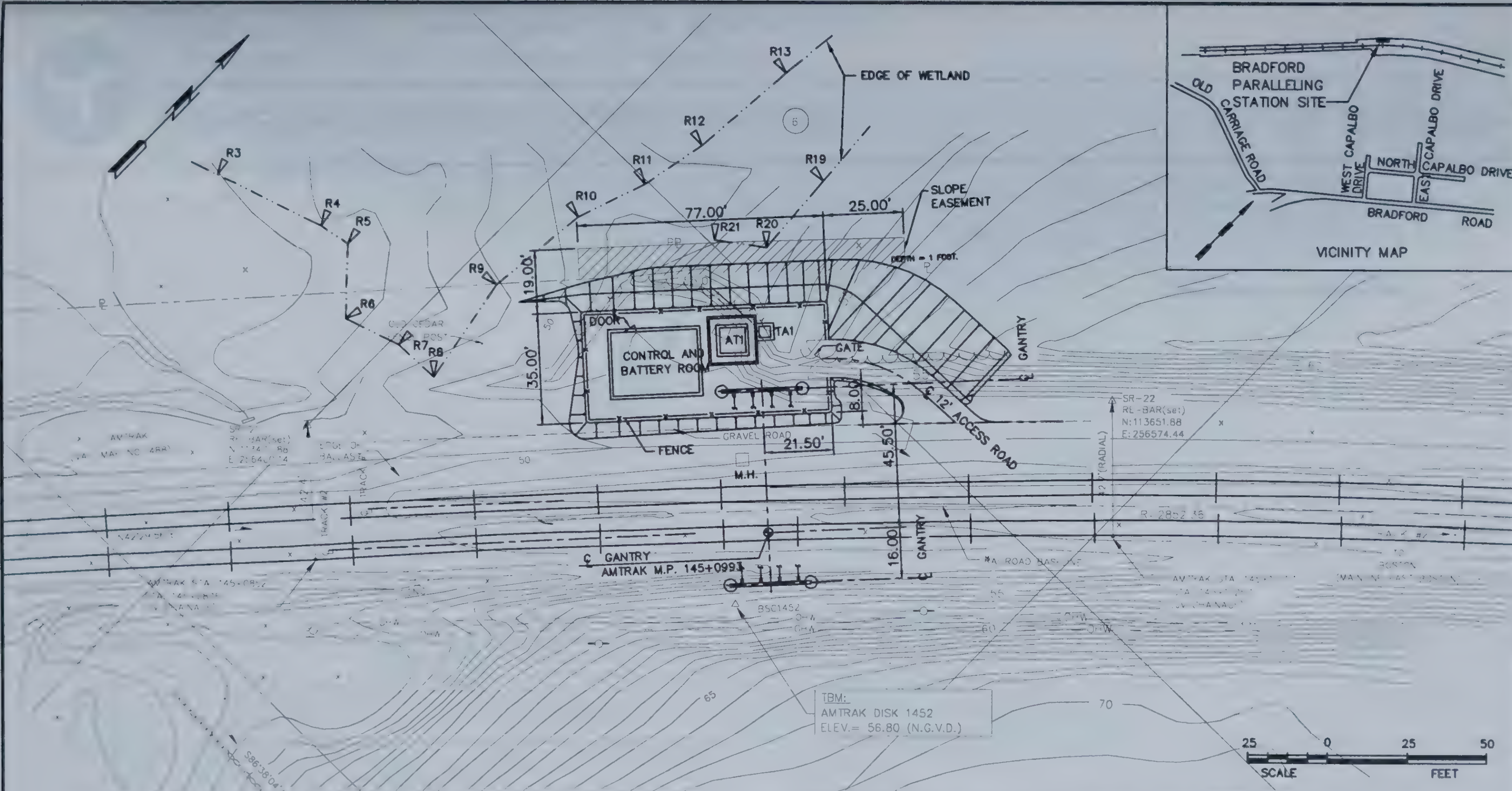


NOTE: PROPOSED FACILITY IS LOCATED OVER THE PAWCATUCK SOLE SOURCE AQUIFER, AND IS DESIGNATED SHORELANDS WITHIN THE COASTAL ZONE.

STATE LINE PARALLELING STATION M.P. 139.93

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–15



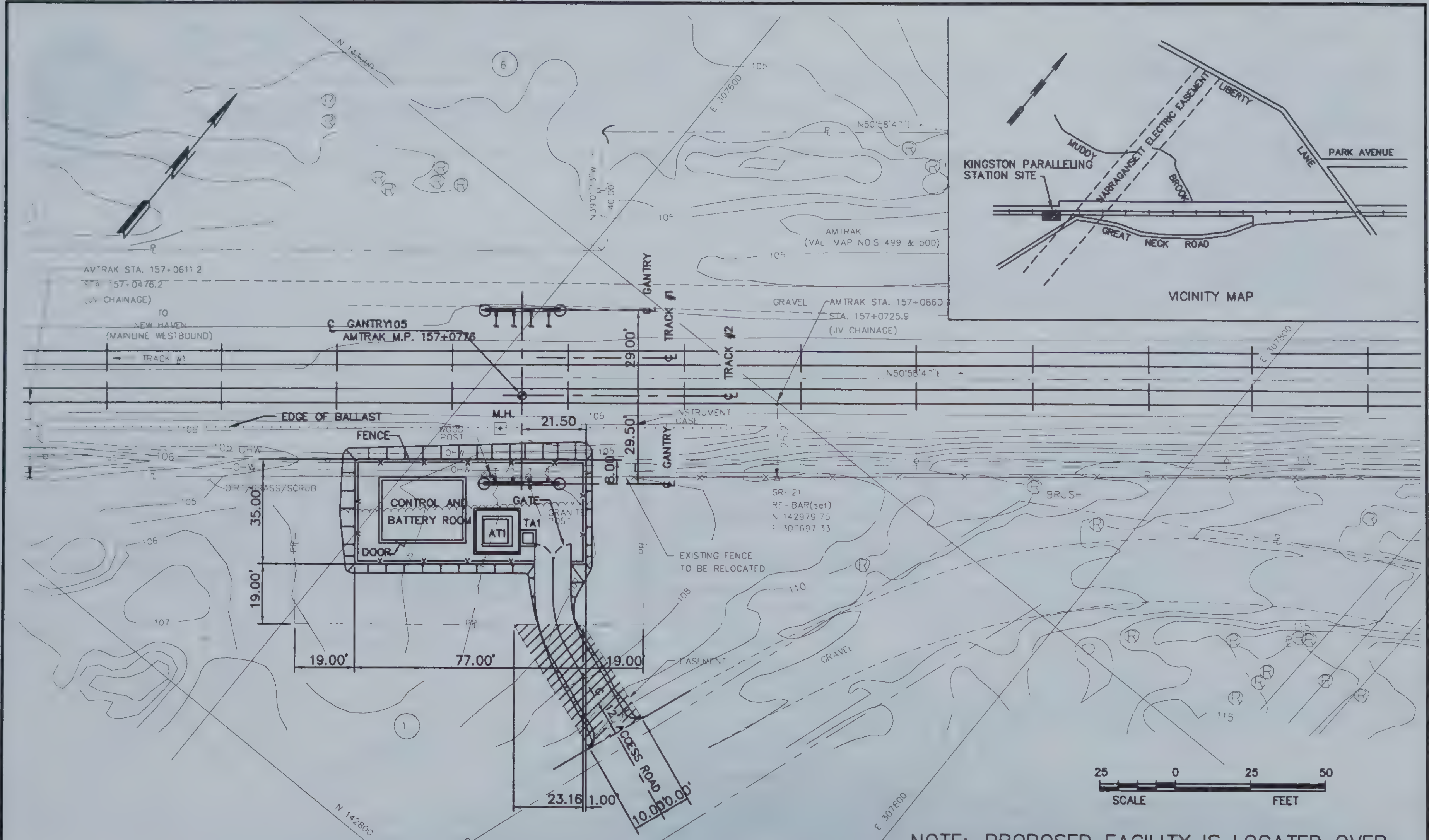
NOTES:

1. PROPOSED FACILITY IS LOCATED OVER THE PAWCATUCK SOLE SOURCE AQUIFER AND WITHIN A CRITICAL GROUNDWATER RECHARGE AREA.
2. PUBLIC WATER SUPPLY WELLS ARE LOCATED APPROX. 1500 FT. EAST AND 3000 FT. SOUTH.

BRADFORD PARALLELING STATION M.P. 145.19

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–16

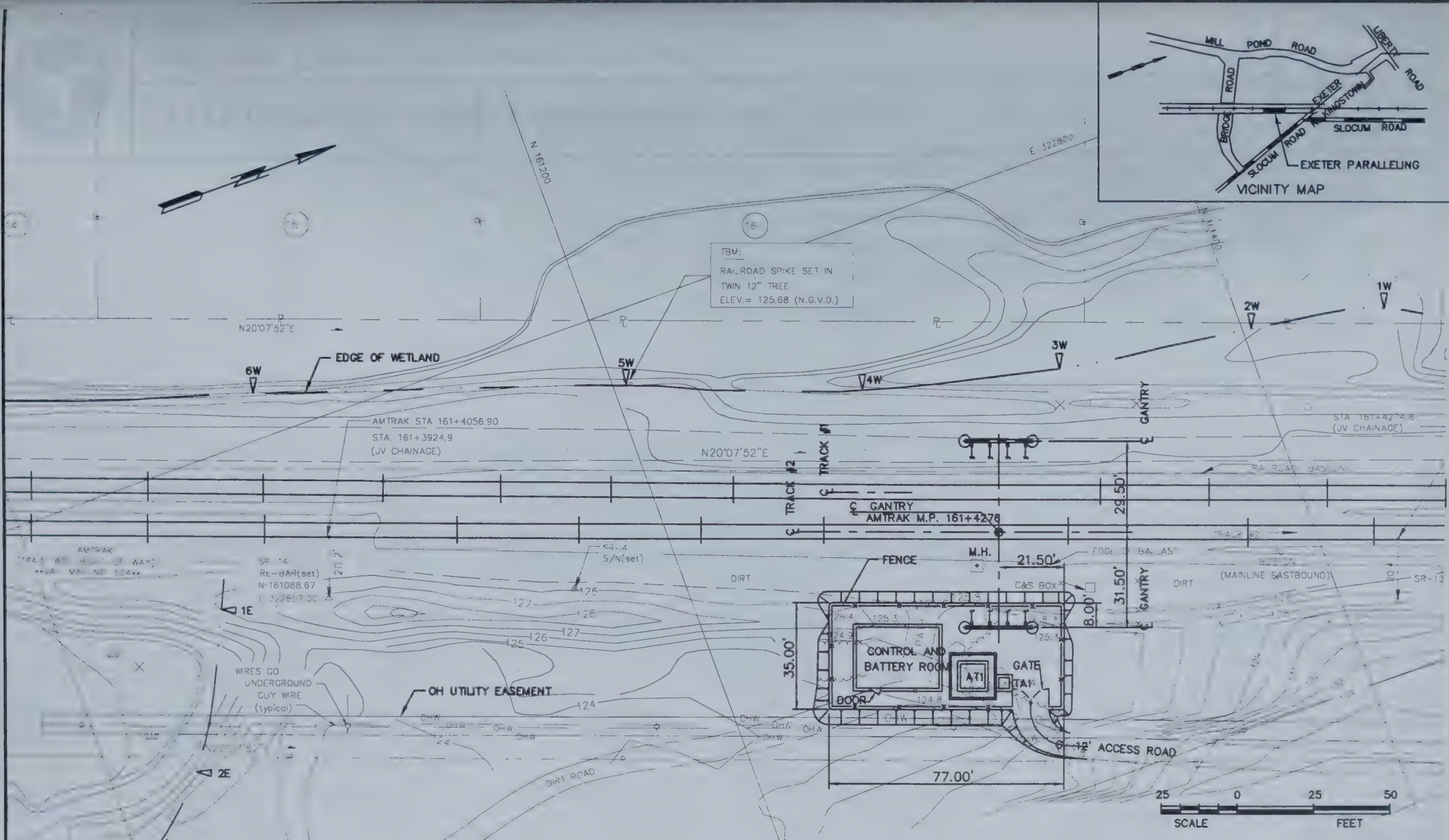


NOTE: PROPOSED FACILITY IS LOCATED OVER THE PAWCATUCK SOLE SOURCE AQUIFER AND IN THE GREAT SWAMP.

KINGSTON PARALLELING STATION M.P. 157.11

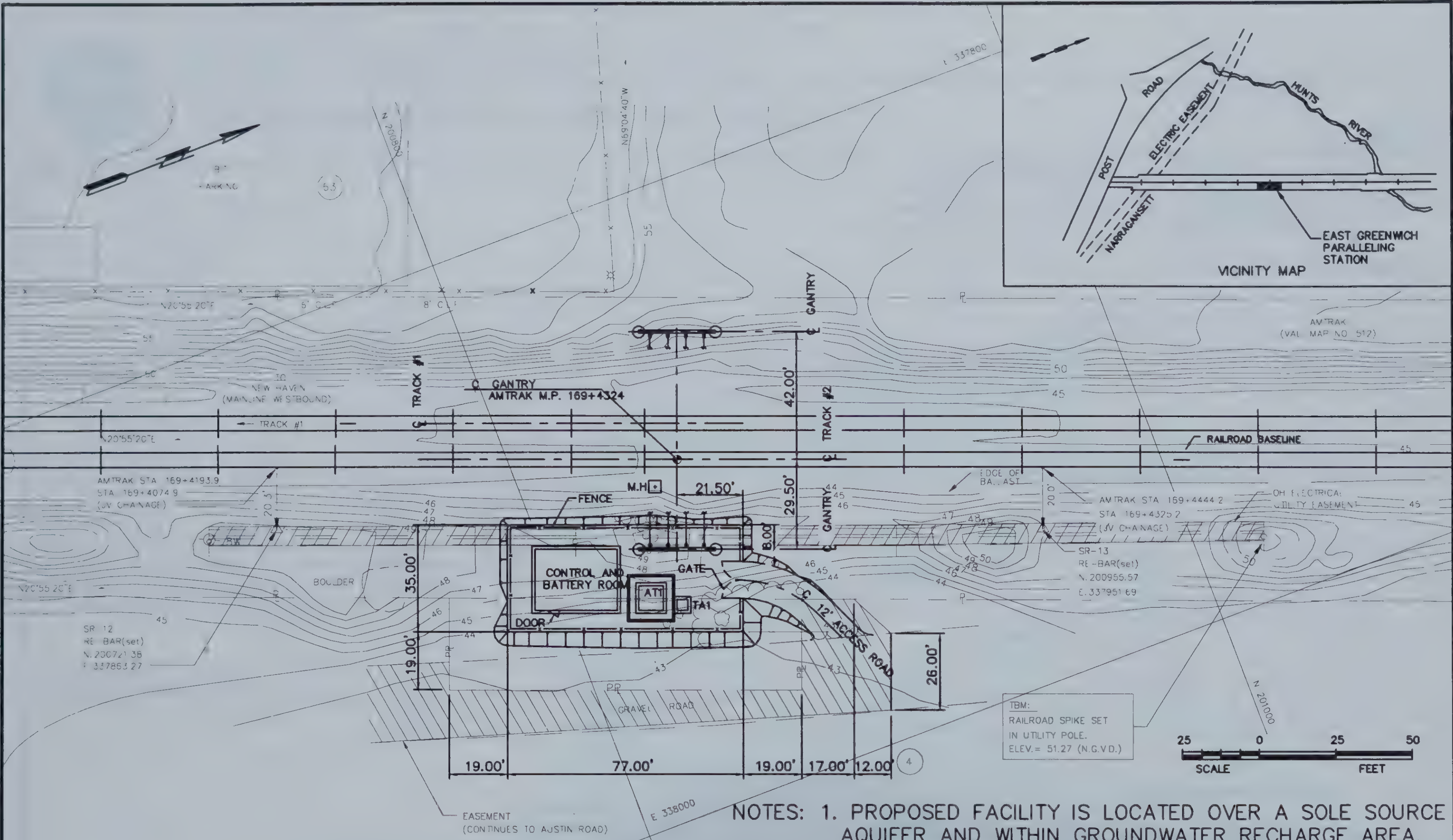
Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–17



NOTE: PROPOSED FACILITY IS LOCATED OVER THE PAWCATUCK SOLE SOURCE AQUIFER. COMMUNITY WELL IS LOCATED APPROX. 3500 FT. SW.

EXETER PARALLELING STATION M.P. 161.78	Figure A–18
Northeast Corridor Improvement Project Electrification – New Haven CT to Boston MA	



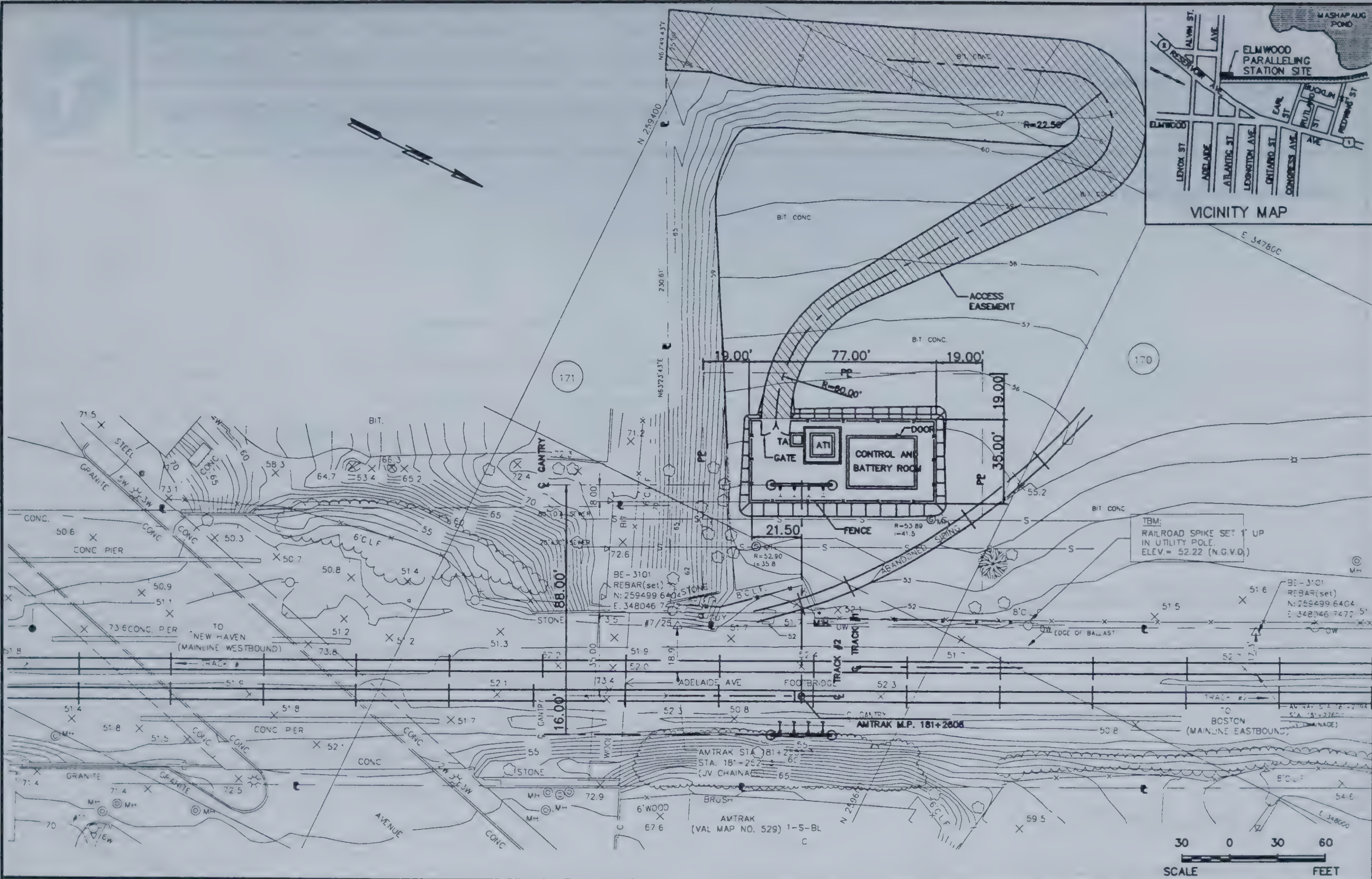
NOTES: 1. PROPOSED FACILITY IS LOCATED OVER A SOLE SOURCE AQUIFER AND WITHIN GROUNDWATER RECHARGE AREA.

2. WATER SUPPLY WELLS ARE LOCATED APPROXIMATELY 1,300 FT. WEST,1500 FT. NORTH,1400 FT. NORTHWEST, AND 4000 FT. SOUTHEAST FROM THE FACILITY SITE.

EAST GREENWICH PARALLELING STATION M.P. 169.80

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

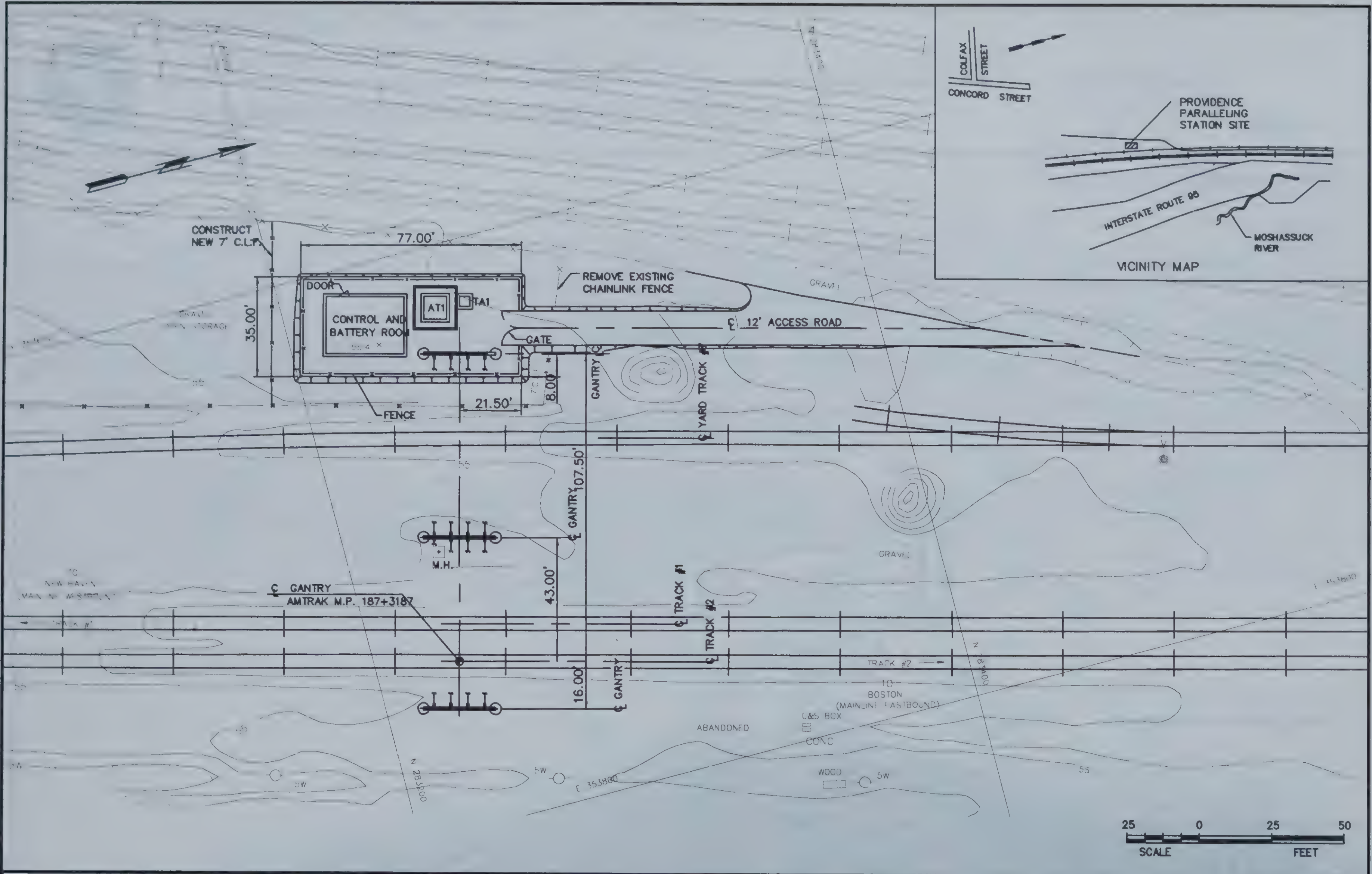
Figure A–19



ELMWOOD PARALLELING STATION M.P. 181.49

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

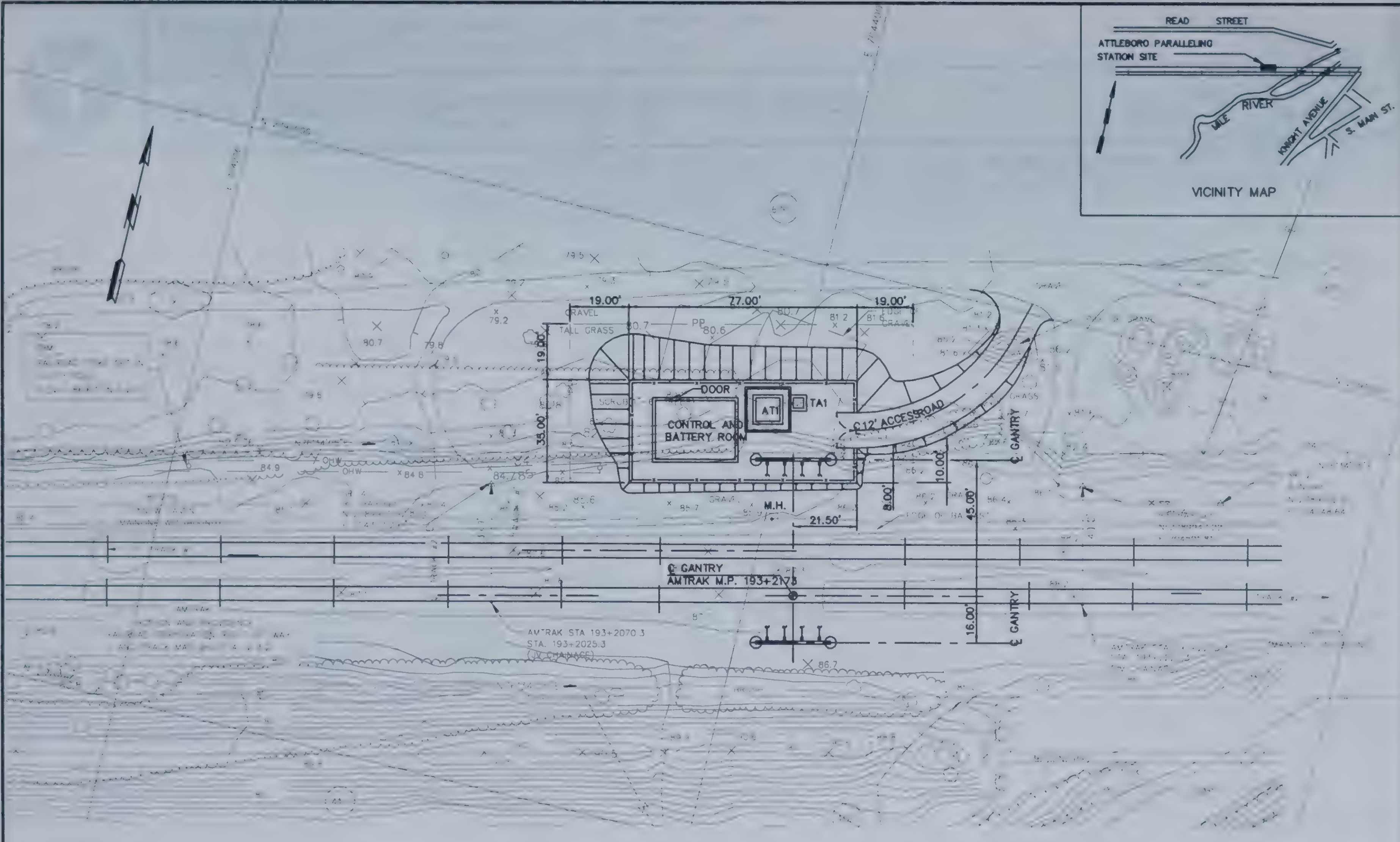
Figure
A–20



PROVIDENCE PARALLELING STATION M.P. 187.45

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–21



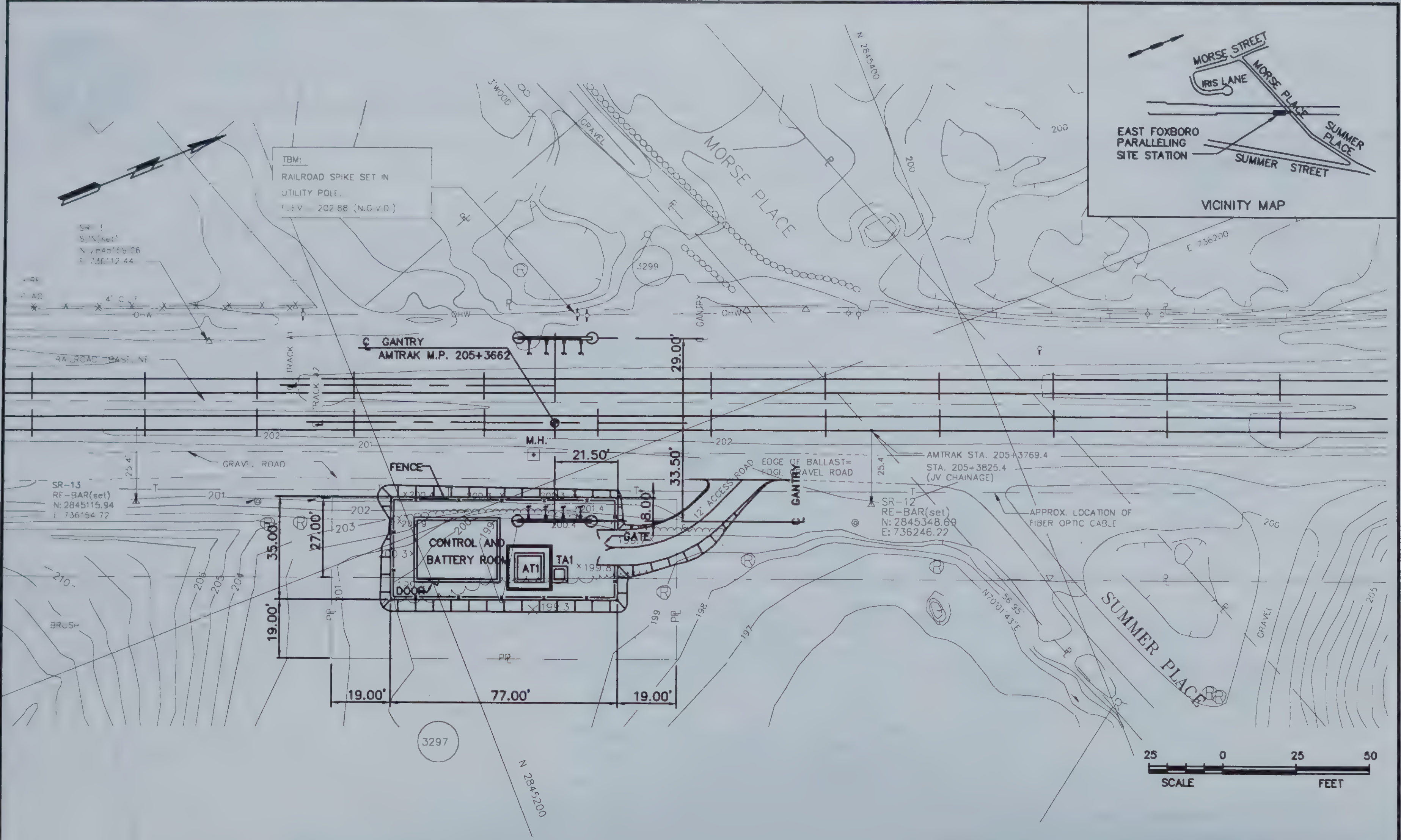
NOTE: PROPOSED FACILITY IS LOCATED UPSTREAM OF THE TEN MILE RIVER.

25 0 25 50
SCALE FEET

ATTLEBORO PARALLELING STATION M.P. 193.40

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–22

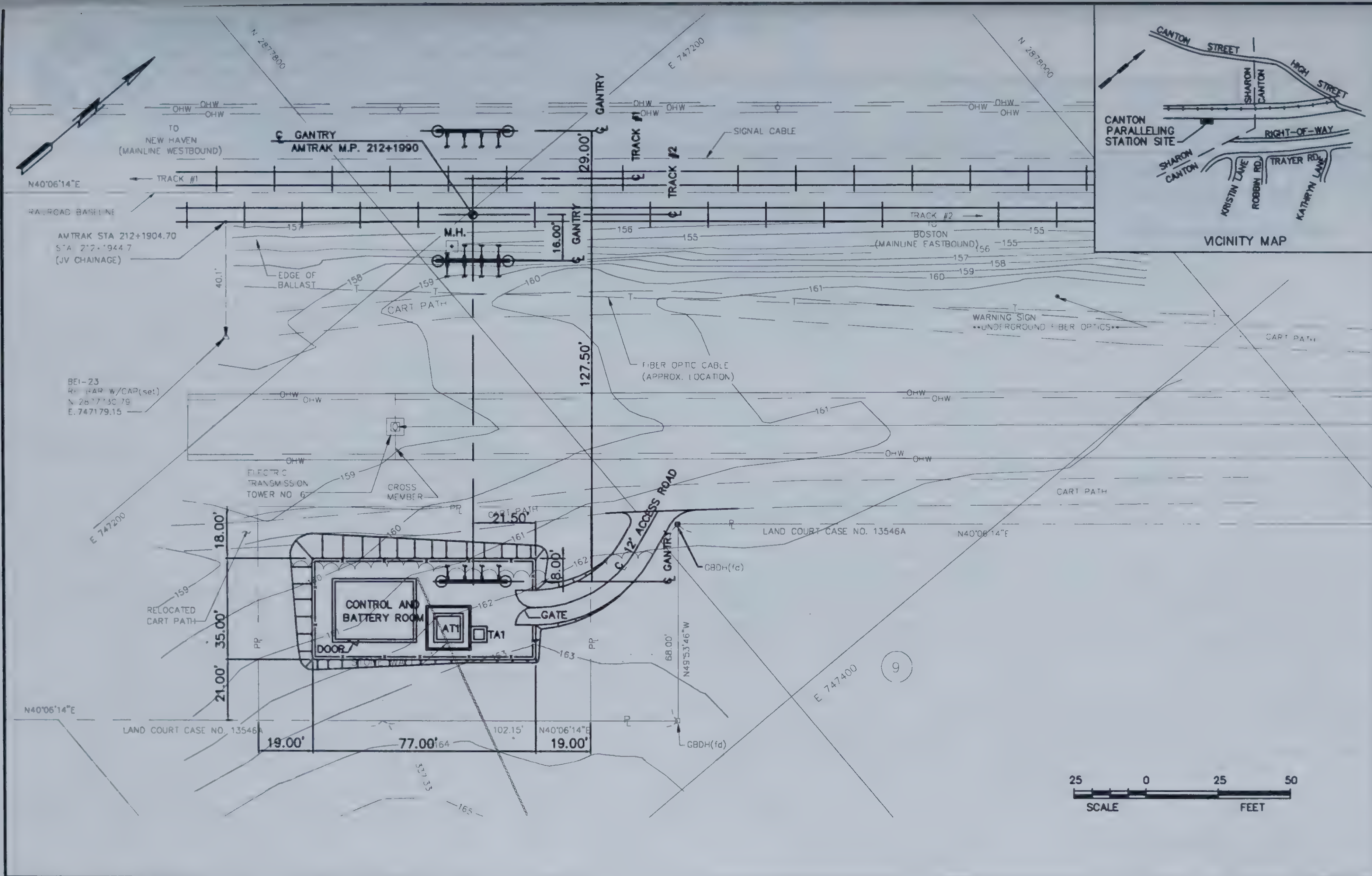


NOTE: PROPOSED FACILITY SITE IS LOCATED WITHIN THE CANOE RIVER A.C.E.C.

EAST FOXBORO PARALLELING STATION M.P. 205.70

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

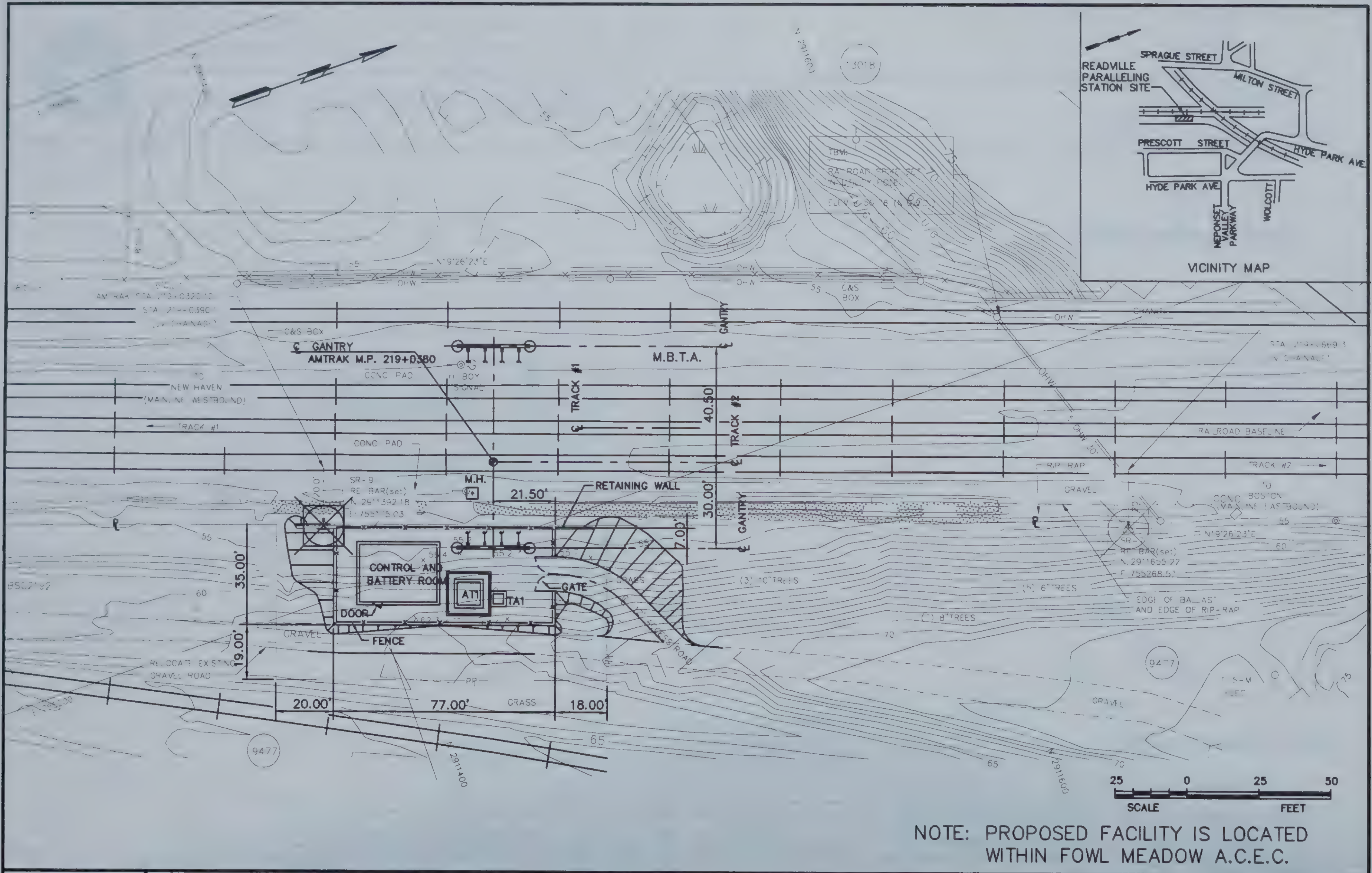
Figure A–23



CANTON PARALLELING STATION M.P. 212.38

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

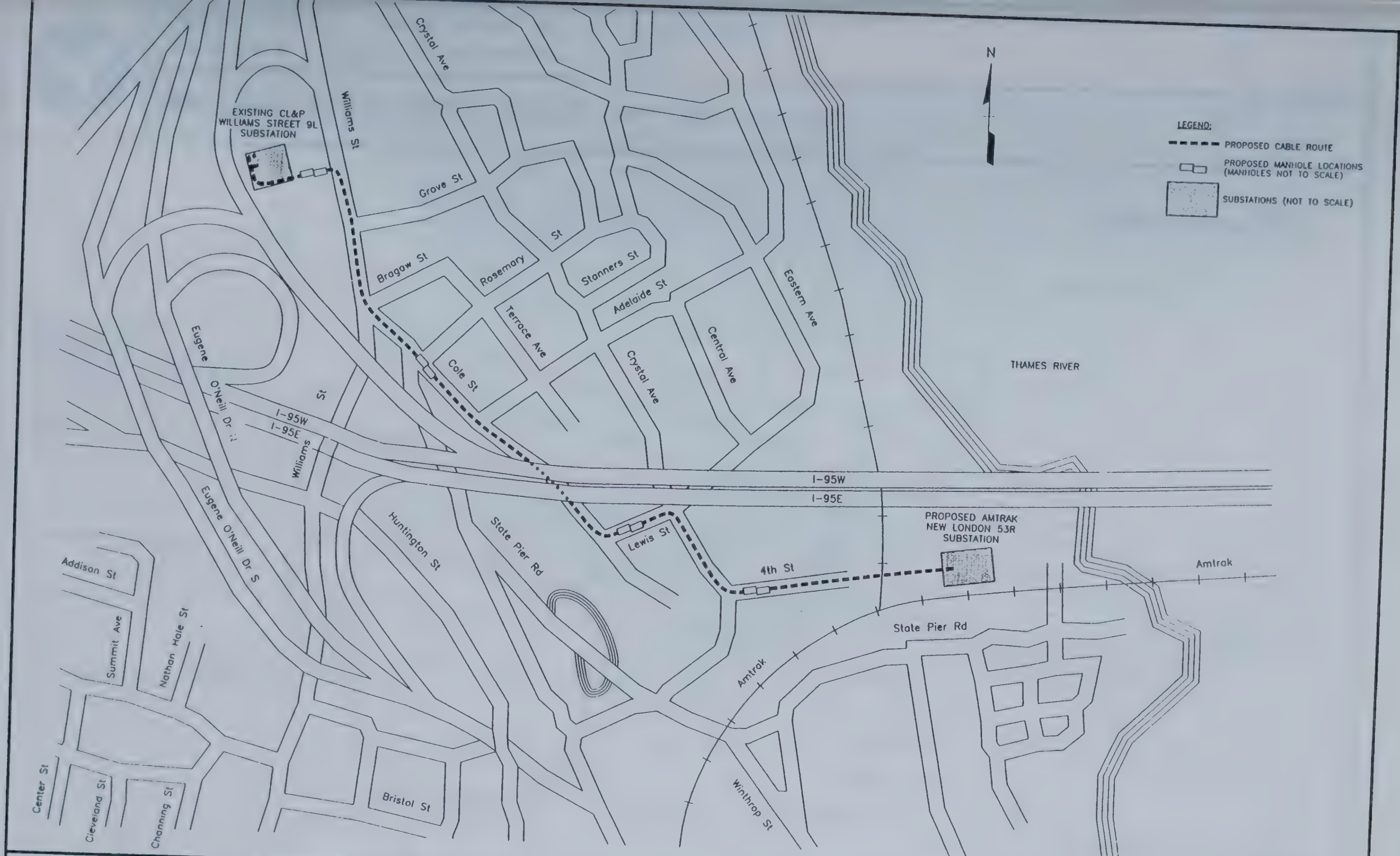
Figure
A–24



READVILLE PARALLELING STATION M.P. 219.08

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

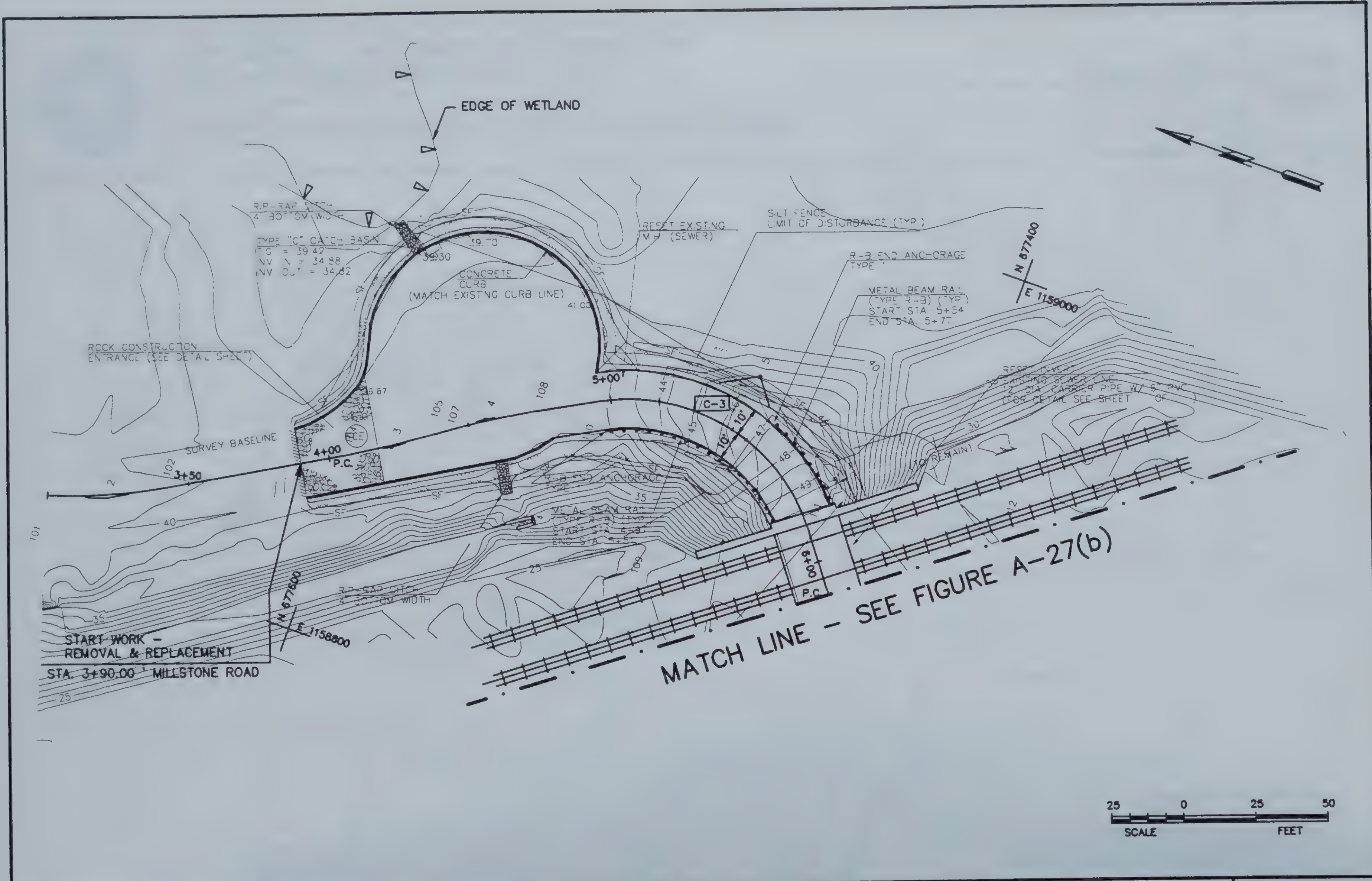
Figure A–25



NEW LONDON SUBSTATION UTILITY CABLE ROUTE

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure A-26



MILLSTONE ROAD (WEST) BRIDGE ALL M.P. 117.31

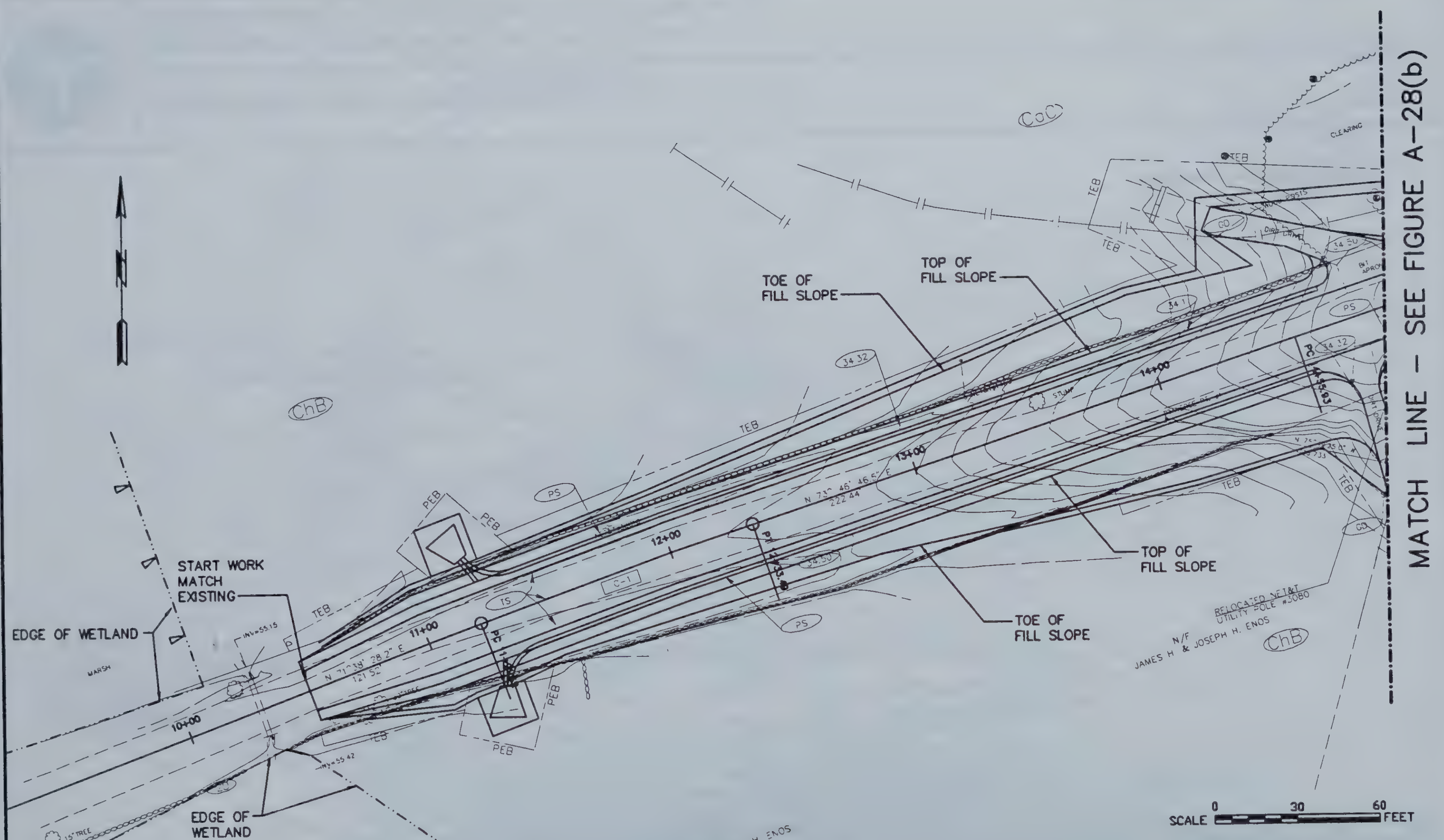
Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A-27(a)

MILLSTONE ROAD (WEST) BRIDGE M.P. 117.31

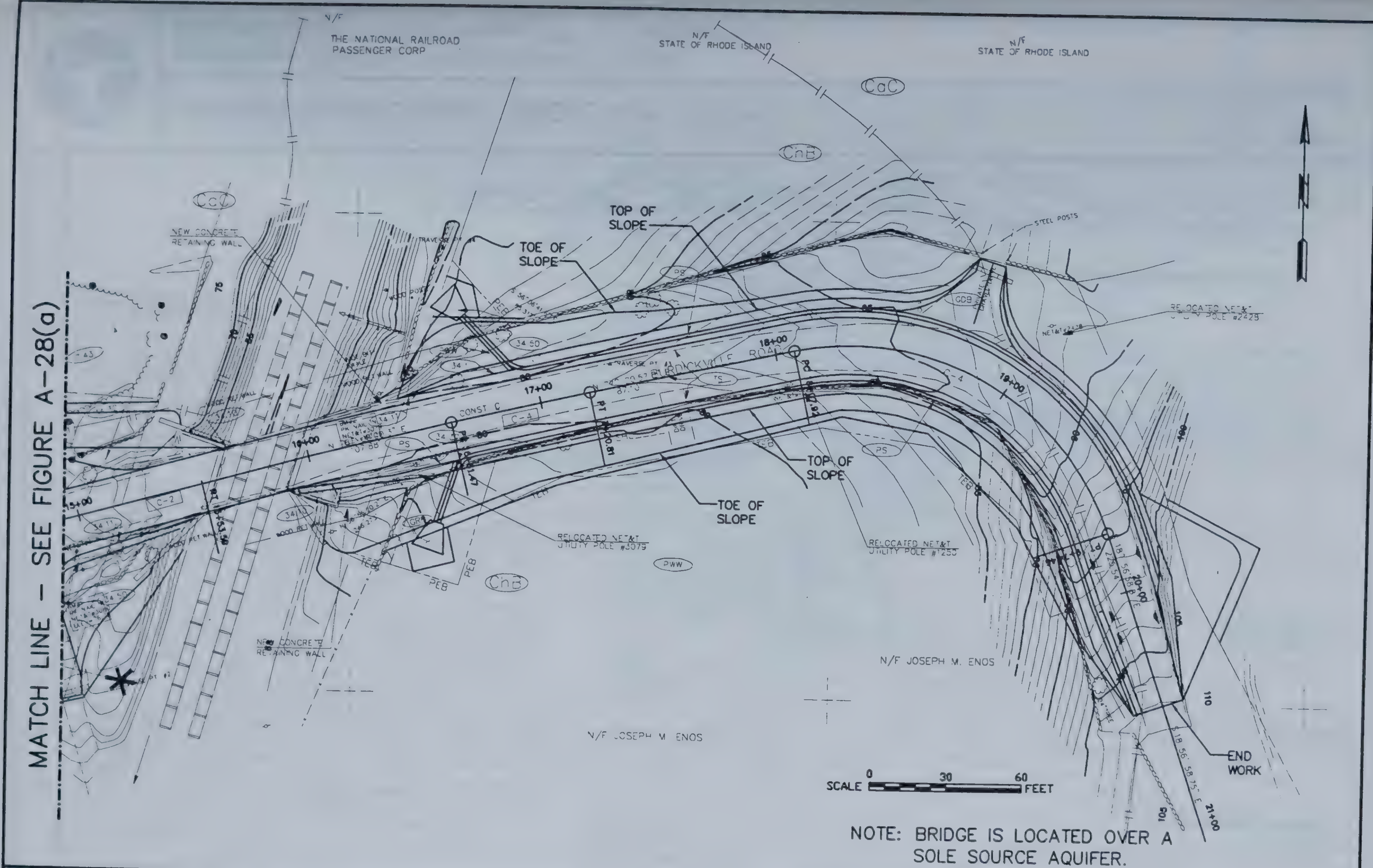
Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–27(b)



NOTE: BRIDGE IS LOCATED OVER THE PAWCATUK SOLE SOURCE AQUIFER.

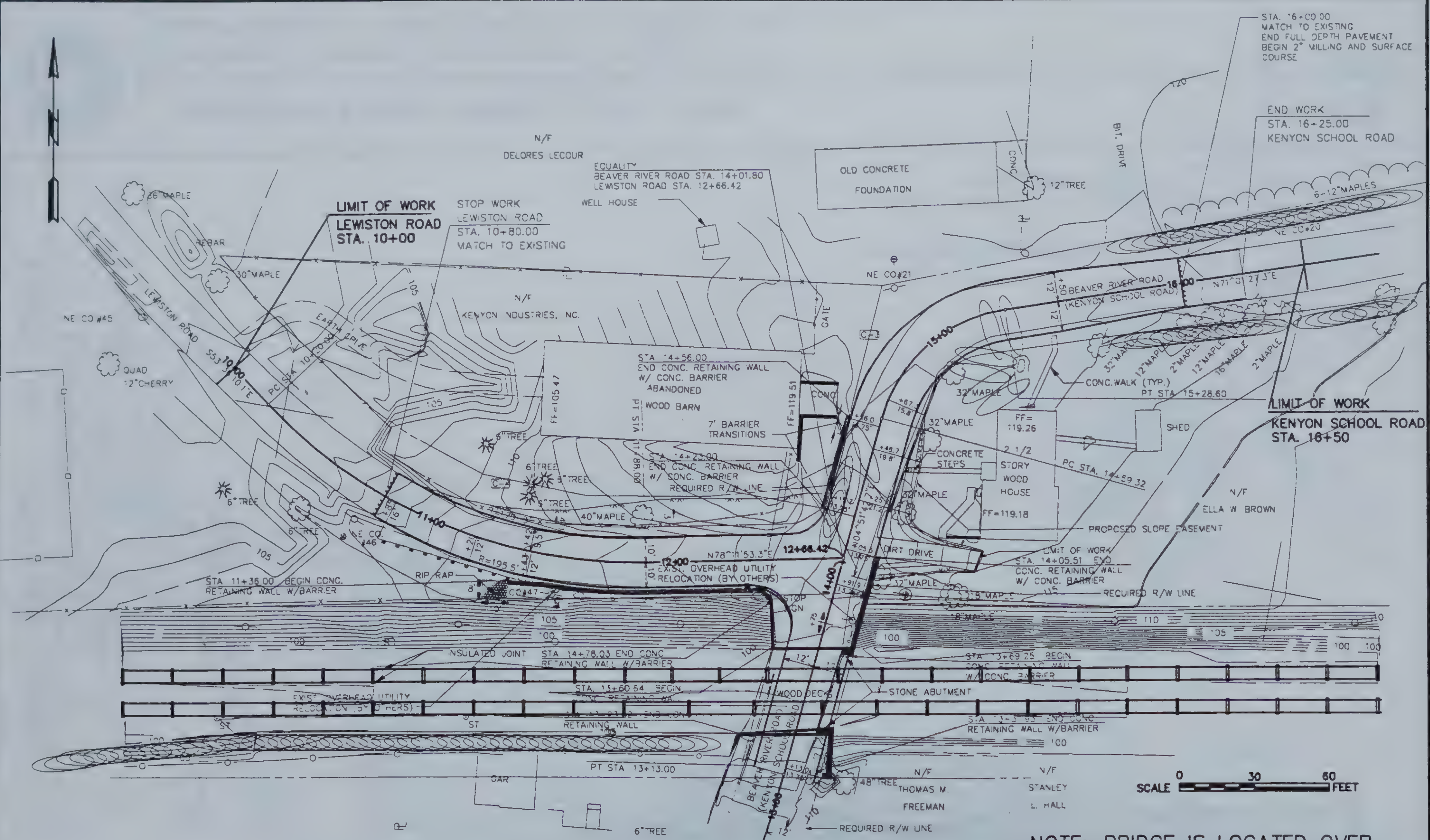
BURDICKVILLE ROAD BRIDGE M.P. 148.41	Figure A-28(a)
Northeast Corridor Improvement Project Electrification – New Haven CT to Boston MA	



BURDICKVILLE ROAD BRIDGE M.P. 148.41

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure A-28(b)



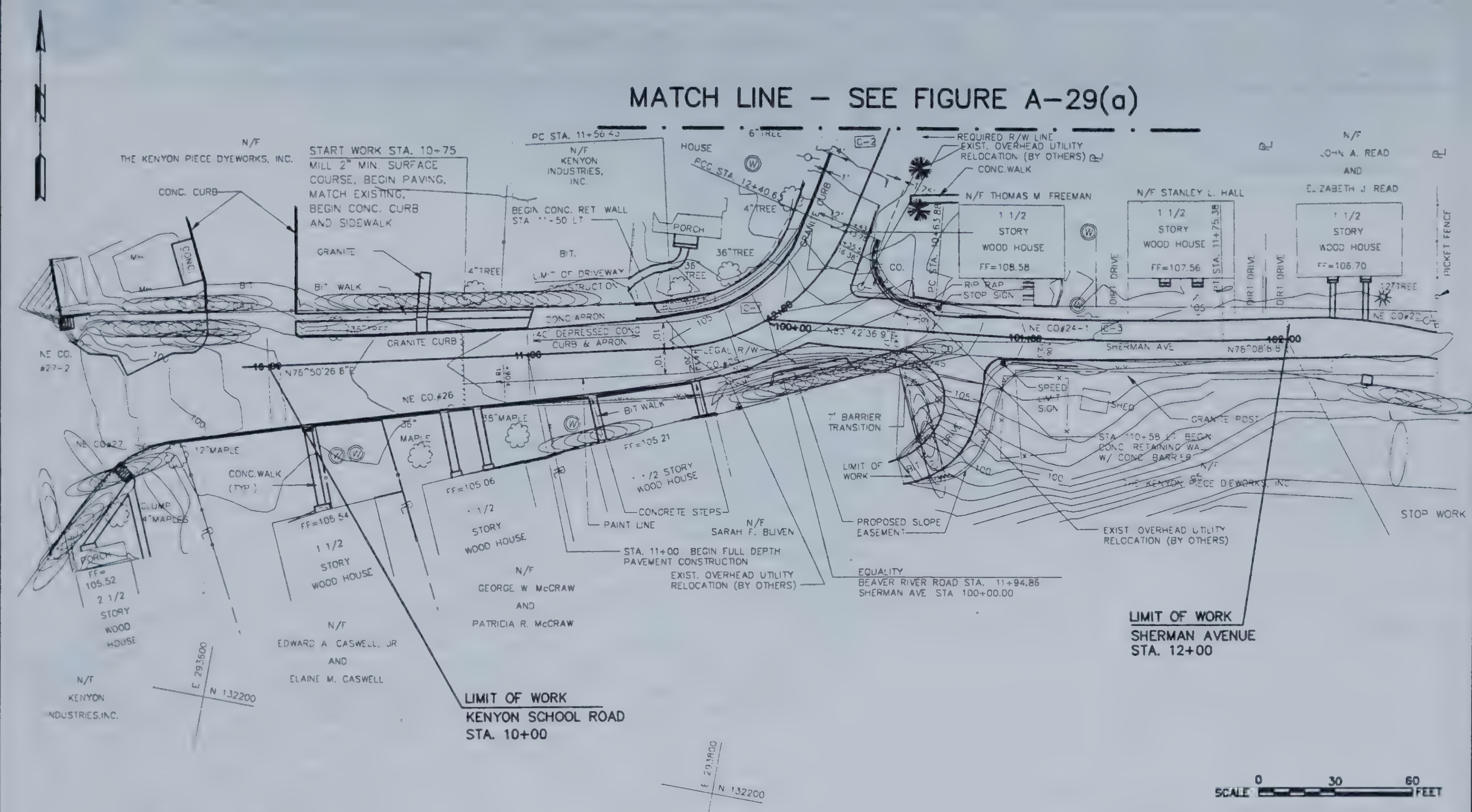
NOTE: BRIDGE IS LOCATED OVER OVER SOLE SOURCE AQUIFER.

MATCH LINE – SEE FIGURE A-29(b)

KENYON SCHOOL ROAD BRIDGE M.P. 154.04

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A-29(a)

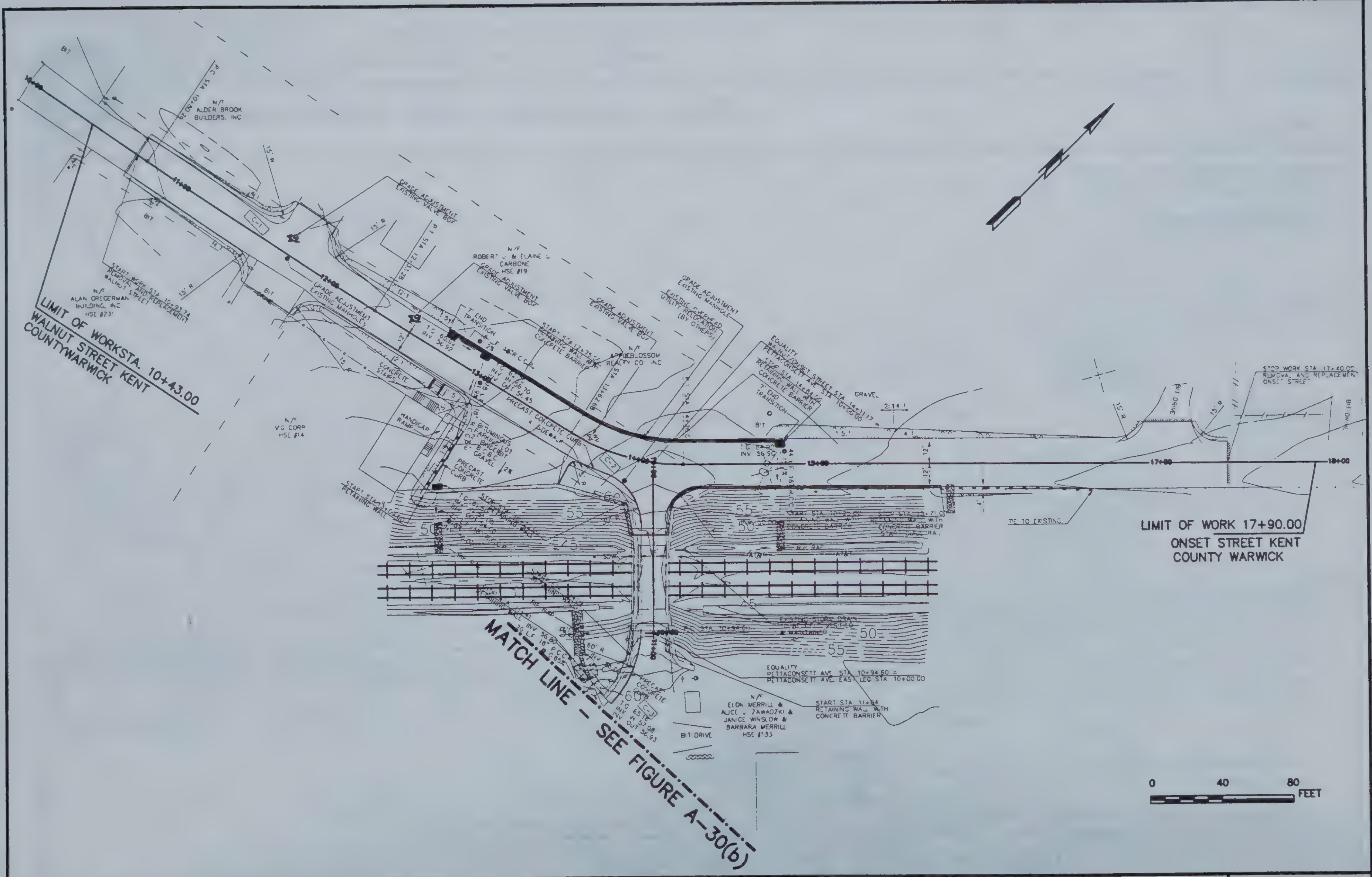


NOTE: BRIDGE IS LOCATED OVER OVER SOLE SOURCE AQUIFER.

KENYON SCHOOL ROAD BRIDGE M.P. 154.04

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–29(b)



PETACONSETT AVENUE BRIDGE M.P. 178.46

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

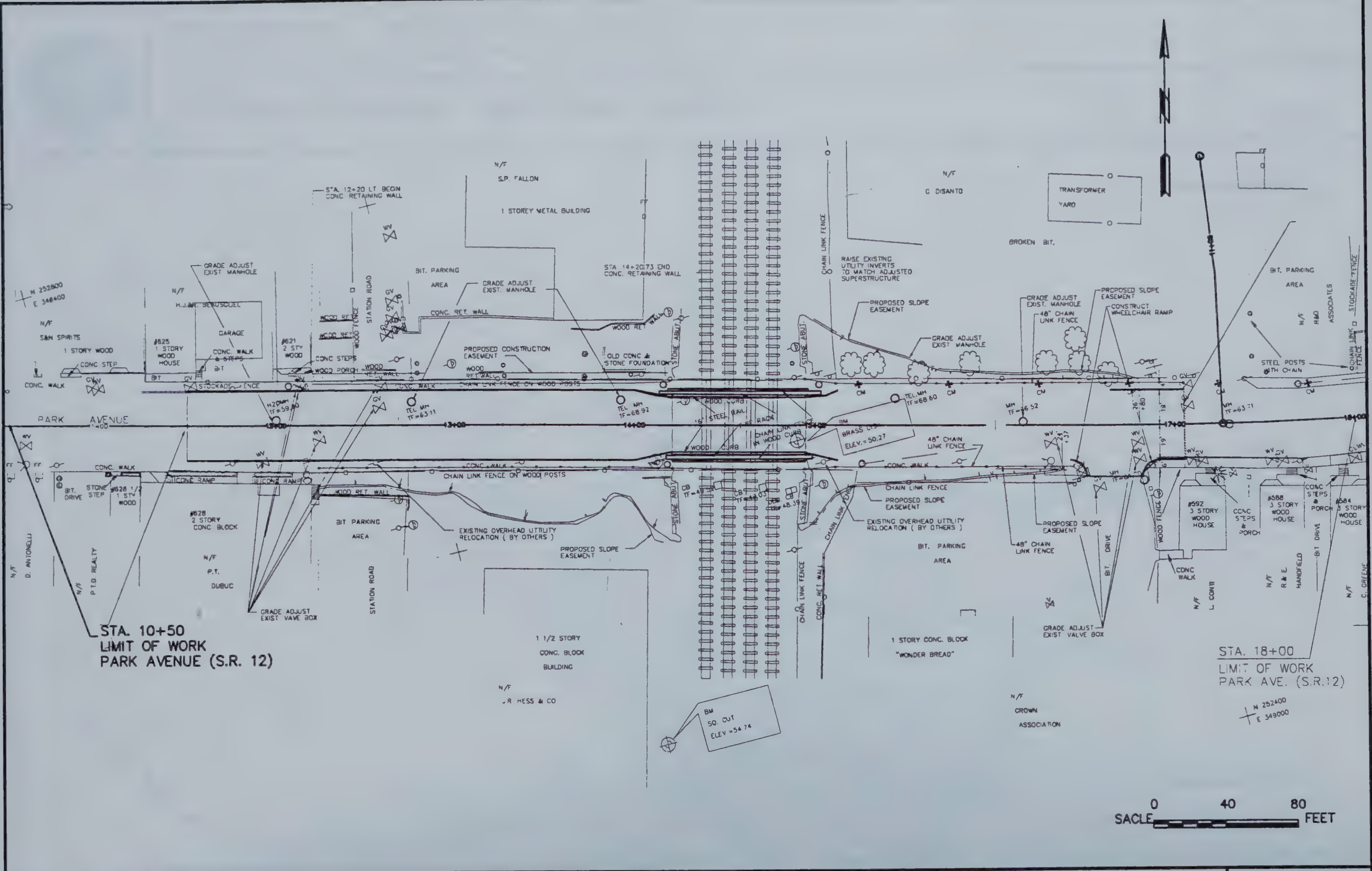
Figure A-30(a)

PETACONSETT AVENUE BRIDGE M.P. 178.46

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure

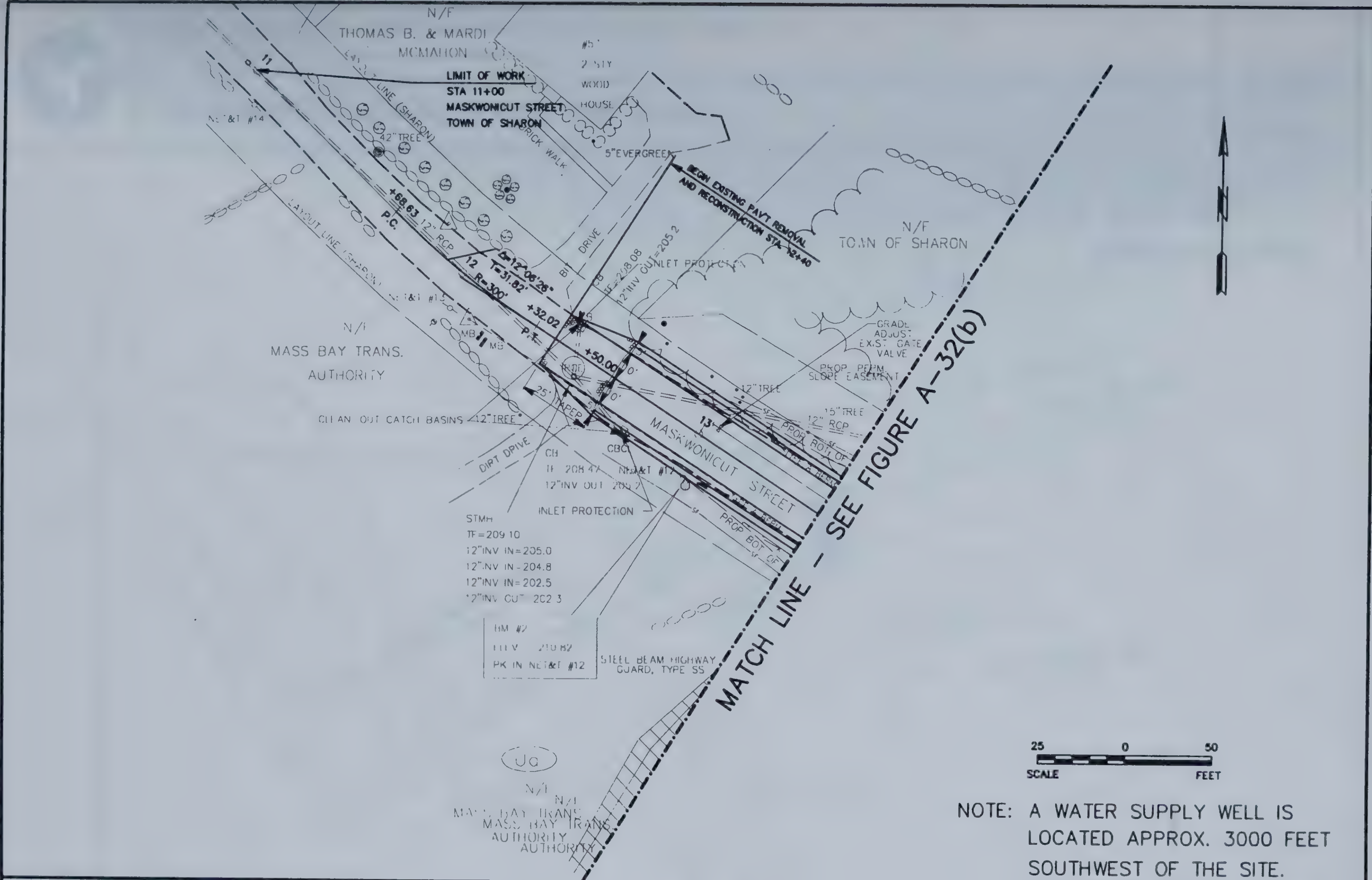
A–30(b)



PARK AVENUE BRIDGE M.P. 180.29

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–31

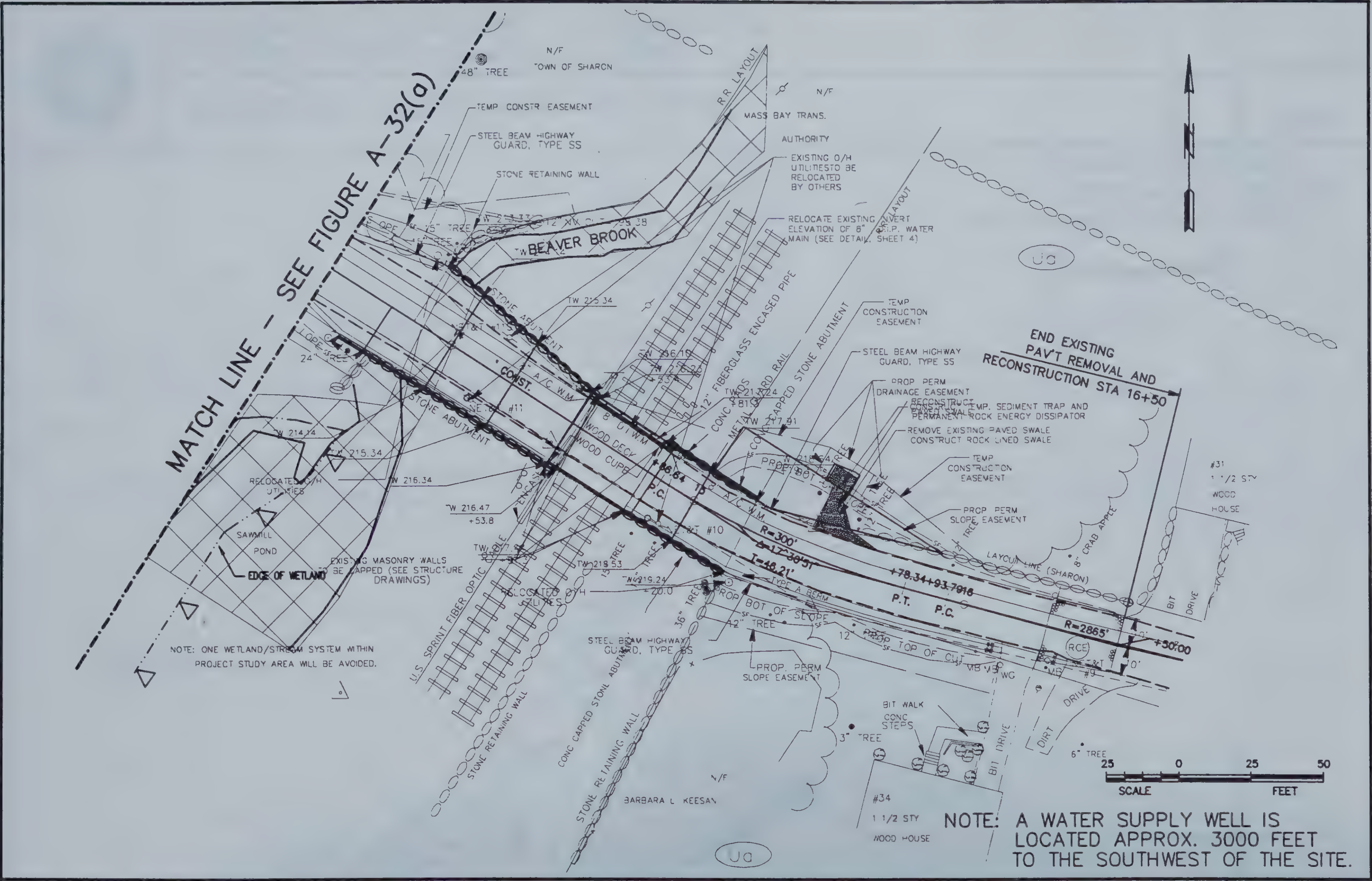


NOTE: A WATER SUPPLY WELL IS LOCATED APPROX. 3000 FEET SOUTHWEST OF THE SITE.

MASKWONICUT STREET BRIDGE M.P. 211.62

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–32(a)



MASKWONICUT STREET BRIDGE M.P. 211.62

Northeast Corridor Improvement Project
Electrification – New Haven CT to Boston MA

Figure A–32(b)

♦ Appendix B

Tables for Chapter 3

TABLE 3.1-1 Facility Zoning

FACILITY	ZONING	CONSISTENT WITH ZONING	CONSISTENT WITH EXISTING LAND USE
Branford SS	Residential (R-5)	no	yes
Leetes Island PS	Residential 5	yes[3]	yes
Madison PS	Residential (RU-2)	yes[1]	yes
Grove Beach PS	Commercial (C)	yes[1]	yes
Westbrook SwS	Industrial (I-1)	yes	yes
Old Lyme PS	Industrial (LI-80)	yes	yes
Millstone PS	General Industrial (I-G)	yes	yes
New London SS	Commercial/Industrial (WCI)	yes	yes
Noank PS	Residential	no	yes
Stonington PS	Coastal (RC-120)	no	yes
State Line PS	Marine Commercial (MC-80)	yes[1]	yes
Bradford PS	Industrial (M-1)	yes	yes
Richmond SwS	Industrial (I)	yes	yes
Kingston PS	Industrial (M1)	yes	yes
Exeter PS	Industrial	yes	yes
East Greenwich PS	Industrial	yes	yes
Warwick SS	General Industrial	yes	no[4]
Elmwood PS	Industrial (M1)	yes	yes
Providence PS	Industrial (MO)	yes	yes
Attleboro PS	Single Residence D	yes[2]	yes
Norton SwS	Single Residence D	yes[2]	no
East Foxboro PS	Residential (R-40)	yes[1]	yes
Canton PS	Single Residence B	yes[1]	yes
Readville PS	Industrial (M-1)	yes	yes
Roxbury Crossing SS	Industrial (M2)	yes	yes

Key: SS - Substation PS - Paralleling Station SwS - Switching Station

NOTES: [1]allowed with special use permit
[2]public or private utilities for essential services permitted
[3]considered exempt
[4]although this use would be consistent with industrial uses, it is considered inconsistent because it would displace an existing use

Sources: Municipal Zoning Departments, 1994

TABLE 3.1-2 Land Uses Adjacent to the Northeast Corridor Rail Line by Municipality (within 1/2 mile either side of ROW)

MUNICIPALITY	MILEAGE	PROJECT FACILITY	PREVALENT LAND USES	SENSITIVE RECEPTORS
New Haven, CT	4.8	None	Industrial, general business, residential, wholesale and distribution, open space/undeveloped areas of the Quinnipiac River and associated wetlands.	8 schools 16 churches 7 recreation areas 3 hospitals 1 nursing home 1 library 1 funeral home
East Haven, CT	1.9	None	Medium and high density residential, commercial, industrial.	1 church 2 recreation areas 1 library 1 nursing home
Branford, CT	6.7	Branford Substation	Undeveloped, wooded or wetland areas. Commercial and industrial uses, medium to high density residential, Pine Orchard Association (1 ac. residential).	5 parks 1 school 1 church 2 libraries
Guilford, CT	5.0	Leetes Island Paralleling Station	Residential, industrial, commercial, municipal.	2 public recreation sites
Madison, CT	4.2	Madison Paralleling Station	Residential, commercial, industrial, undeveloped.	5 recreation areas 1 school 2 churches 1 library 1 cemetery 1 public well site
Clinton, CT	4.1	None	Medium density residential, industrial, golf course, agricultural, dump site, industrial, commercial, municipal, wetlands.	2 schools 4 churches 3 cemeteries 1 nursing home 2 recreation sites 1 funeral home
Westbrook, CT	3.5	Grove Beach Paralleling Station	Residential, industrial, commercial, I-95.	3 schools 5 recreation sites 1 library 1 church
Old Saybrook, CT	4.4	Westbrook Switching Station	I-95, undeveloped, commercial, residential, industrial, commercial.	3 schools 2 nursing homes 2 recreation sites 1 funeral home 1 cemetery
Old Lyme, CT	5.6	Old Lyme Paralleling Station Johnnycake Hill Road Bridge	Low to medium density residential, undeveloped, commercial, industrial, wetlands, golf course.	5 recreation sites

Table 3.1-2 Land Uses Adjacent to the Northeast Corridor Rail Line by Municipality (continued)

MUNICIPALITY	MILEAGE	PROJECT FACILITY	PREVALENT LAND USES	SENSITIVE RECEPTORS
East Lyme, CT	4.4	None	Residential, commercial, light industrial, Long Island Sound, Niantic Bay.	4 recreational areas 2 funeral homes
Waterford, CT	4.2	Millstone Paralleling Station Millstone Point Road Bridge	Open space, residential.	10 recreation areas 1 hospital 1 school
New London, CT	3.0	New London Substation	Industrial, commercial, high density residential, water.	7 parks 2 hospitals 2 school 1 nursing home 1 church 3 funeral homes
City of Groton, CT	1.0	None	I-95, industrial, high density residential, open space, commercial.	9 recreation sites 3 schools 2 nursing homes
Town of Groton, CT	7.1	Noank Paralleling Station	Medium density residential, open spaces (including Haley Farm State Park), coastal features (the railroad crosses over approximately 7 waterways), commercial, industrial, coastal wetlands, Bluff Point State Park, airport, high and medium density residential, commercial, industrial.	2 state parks 2 schools numerous recreation areas
Stonington, CT	9.0	Stonington Paralleling Station State Line Paralleling Station	Open space, low and medium density residential, industrial, commercial Long Island Sound and associated wetlands.	5 recreational areas 2 nursing homes 1 cemetery 2 churches Barn Island Hunting Area
Westerly, RI	5.3	Bradford Paralleling Station	Undeveloped, industrial, commercial, high density residential, commercial.	2 recreation areas Burlingame State Park Chapman Pond 1 nursing home 1 library 3 churches
Hopkinton, RI	1.0	None	Undeveloped, wetlands.	None
Charlestown, RI	4.6	Burdickville Road Bridge	Low density residential, industrial, wetlands.	Burlingame Management Area
Richmond, RI	3.7	Richmond Switching Station Kenyon School Road Bridge	Undeveloped, low density residential, industrial.	2 churches

Table 3.1-2 Land Uses Adjacent to the Northeast Corridor Rail Line by Municipality (continued)

MUNICIPALITY	MILEAGE	PROJECT FACILITY	PREVALENT LAND USES	SENSITIVE RECEPTORS
South Kingstown, RI	4.5	Kingston Paralleling Station	Low density residential, medium density residential, commercial, industrial, wetlands.	1 church
Exeter, RI	1.7	Exeter Paralleling Station	Low density residential.	1 recreation area
North Kingstown, RI	7.9	East Greenwich Paralleling Station	Industrial, commercial, residential.	2 schools 2 recreation areas 6 churches
East Greenwich, RI	1.7	None	Medium and high density residential, commercial.	1 school 4 churches 5 recreational areas
Warwick, RI	7.7	Warwick Substation Pettaconsett Avenue Bridge	Medium density residential, commercial, industrial, recreational.	3 schools 5 recreation areas 1 cemetery 3 churches
Cranston, RI	2.0	Park Avenue Bridge	Industrial, manufacturing, high density residential, commercial.	2 schools 3 recreation areas 2 churches 1 elderly housing
Providence, RI	6.8	Elmwood Paralleling Station	Industrial, commercial, high density residential.	18 schools 24 recreation sites 7 churches 1 hospital 2 elderly housing 1 library 1 cemetery
Pawtucket, RI	2.6	Providence Switching Station	Industrial, commercial, high density residential.	9 schools 11 recreation sites 2 libraries 1 cemetery 2 churches
Central Falls, RI	0.6	None	Commercial, industrial, high density residential.	4 schools 3 recreation sites 3 churches 1 nursing homes 1 hospital 1 library
Attleboro, MA	8.5	Attleboro Paralleling Station Norton Switching Station	Commercial, industrial, medium density residential.	1 school 2 recreation areas 2 churches
Mansfield, MA	5.5	None	Industrial, medium and high density residential.	1 school 1 recreation area 1 church
Foxboro, MA	2.7	East Foxboro Paralleling Station	Undeveloped and low density residential, industrial.	1 recreation area

Table 3.1-2 Land Uses Adjacent to the Northeast Corridor Rail Line by Municipality (continued)

MUNICIPALITY	MILEAGE	PROJECT FACILITY	PREVALENT LAND USES	SENSITIVE RECEPTORS
Sharon, MA	5.1	Canton Paralleling Station Maskwonicut Street Bridge	Low and medium density residential, commercial.	4 recreation areas 1 hospital 1 church 1 funeral home
Canton, MA	3.7	None	Industrial, commercial, low density residential and undeveloped.	3 schools 1 library
Westwood, MA	0.8	None	Wetlands, open space, industrial.	None
Dedham, MA	1.7	None	Wetlands, open space, industrial.	1 school
Boston, MA	10.1	Roxbury Crossing Substation	High and medium density residential, industrial, commercial.	52 schools 37 recreation areas 10 hospitals 2 libraries 4 nursing homes 17 churches

Source: Applied Geographics and DMJM/Harris, 1993

TABLE 3.1-3 Prime and Important Farmland Soil Types

PROJECT FACILITY	COUNTY	SOIL TYPES	DEGREE OF AGRICULTURAL IMPORTANCE
Branford SS - 1,200-foot aerial feeder utility corridor	New Haven	Whethersfield loam (WkC)	WkC - Qualifies as Additional Farmland of Statewide Importance
New London SS	New London	Udorthents, smoothed (Ud)	Ud - Does not qualify as agriculturally important
Warwick SS	Providence	Udorthents - Urban land complex (Ud)	Ud - Does not qualify as agriculturally importance
Roxbury SS	Suffolk	Udorthents, loamy (Ud), Urban land, 0 to 15 percent slopes (Ur)	Ud and Ur - Do not qualify as agriculturally important
Westbrook SwS	Middlesex	Hinckley gravelly sandy loam, 3 to 15 percent slopes (HkC)	HkC - Qualifies as Additional Farmland of Statewide Importance
Richmond SwS	Washington	Merrimac sandy loam, 0 to 3 percent slopes (MmA)	MmA - Qualifies as Prime Farmland
Norton SwS	Bristol	Paxton extremely stony fine sandy loam, 0 to 8 percent slopes (PcB)	PcB - Does not qualify as agriculturally important
Leetes Island PS	New Haven	Westbrook mucky peat (We)	We - Does not qualify as agriculturally important
Madison PS	New Haven	Carlisle muck (Ce), Hinckley gravelly sandy loam, 3 to 8 percent slopes (when irrigated) (HkB)	HkB - Qualifies as Prime Farmland Ce - Does not qualify as agriculturally important
Grove Beach PS	Middlesex	Carlisle muck (Ce)	Ce - Does not qualify as agriculturally important
Old Lyme PS	New London	Scarboro mucky fine sandy loam (Sf)	Sf - Does not qualify as agriculturally important
Millstone PS	New London	Udorthents, smoothed (Ud)	Ud - Does not qualify as agriculturally important
Noank PS	New London	Sutton extremely stony fine sandy loam, 0 to 8 percent slope (SxB)	SxB - Does not qualify as agriculturally important
Stonington PS	New London	Charlton-Hollis fine sandy loams, very rocky, 3 to 5 percent slopes (CrC)	CrC - Does not qualify as agriculturally important
State Line PS	New London	Merrimac sandy loam, 0 to 3 percent slopes (MyB)	MyB - Qualifies as Prime Farmland
Bradford PS	Washington	Windsor loamy sand, 3 to 8 percent slopes (WgB)	WgA - Qualifies as Additional Farmland of Statewide Importance

TABLE 3.1-3 Prime and Important Farmland Soil Types (continued)

PROJECT FACILITY	COUNTY	SOIL TYPES	DEGREE OF AGRICULTURAL IMPORTANCE
Kingston PS	Washington	Canton and Charlton very stony fine sandy loams, 3 to 8 percent slopes (ChB)	ChB - Does not qualify as agriculturally important
Exeter PS	Washington	Enfield silt loam, 3 to 8 percent slopes (EfB)	EfB - Qualifies as Prime Farmland
East Greenwich PS	Kent	Pits, gravel (Pg)	Pg - Does not qualify as agriculturally important
Elmwood PS	Providence	Udorthents - Urban land complex (Ud)	Ud - Does not qualify as agriculturally important
Providence PS	Providence	Udorthents - Urban land complex (Ud)	Ud - Does not qualify as agriculturally important
Attleboro PS Station	Bristol	Windsor loamy sand, 0 to 3 percent slopes (WnA)	WnA - Does not qualify as agriculturally important
East Foxboro PS	Norfolk	Hinkley sandy loam, 8 to 15 percent slopes (HfC)	HfC - Does not qualify as agriculturally important
Canton PS	Norfolk	Deerfield loamy sand, 3 to 8 percent slopes (DeB), Canton fine sandy loam, 15 to 35 percent slopes (CaD)	DeB - Qualifies as Farmland of State/Local Importance.
Readville PS	Suffolk	Udorthents, loamy (Ud)	Ud - Does not qualify as agriculturally important

Source: U.S.D.A. Soil Conservation Service, 1976

TABLE 3.2-1 Employment by Industry in the Project Corridor

INDUSTRY	CT	RI	MA	TOTAL	%
Services	67,646	80,815	153,663	302,124	33.73
Manufacturing	33,929	58,709	113,439	206,077	23.01
Retail Trade	29,307	42,619	79,609	151,535	16.92
Finance	11,436	16,982	33,359	61,777	6.90
Construction	10,535	12,441	23,768	46,744	5.22
Administration	7,558	10,908	20,102	38,568	4.31
Wholesale Trade	5,833	8,414	17,849	32,096	3.58
Transportation	5,969	7,731	14,291	27,991	3.13
Communications	6,145	4,461	9,006	19,612	2.19
Agriculture	1,460	2,791	4,348	8,599	0.96
Mining	151	143	259	553	0.06
TOTAL	179,969	246,014	469,693	895,676	100.00

Source: U.S. Census Bureau, 1990

TABLE 3.2-2 Census Tract Information

FACILITY	POPULATION	MEDIAN INCOME	RACE DISTRIBUTION[1]
Grove Beach PS (Tract 6801)	5,379	$37,534	White - 97.4 Black - 1.5 Amer Ind./Esk. - 0.0 Asian/Pac. Isl. - 0.4 Other[2] - 0.8
New London SS (Tract 6901)	3,485	$21,392	White - 52.3 Black - 22.7 Amer Ind./Esk. - 0.5 Asian/Pac. Isl. - 2.2 Other[2] - 22.5
Noank PS (Tract 7029)	2,556	$49,042	White - 96.0 Black - 1.3 Amer Ind./Esk. - 0.8 Asian/Pac. Isl. - 1.8 Other[2] - 0.2
Warwick SS (Tract 211)	5,382	$32,450	White - 97.6 Black - 1.0 Amer Ind./Esk. - 0.2 Asian/Pac. Isl. - 0.7 Other[2] - 0.5
Elmwood PS (Tract 15)	2,479	$31,294	White - 76.8 Black - 9.2 Amer. Ind./Esk.- 0.8 Asian/Pac. Isl.- 10.5 Other[2] - 2.7
Providence PS (Tract 8)	2,460	$9,551	White - 87.4 Black - 6.7 Amer. Ind./Esk.- 0.6 Asian/Pac. Isl.- 3.4 Other[2] - 2.0
Readville PS (Tract 1402)	7,447	$36,198	White - 93.2 Black - 4.9 Amer. Ind./Esk. - 0.0 Asian/Pac. Isl. - 0.6 Other[2] - 1.3
Roxbury Crossing SS (Tract 808)	2,736	$16,654	White - 13.4 Black - 38.1 Amer Ind./Esk. - 0.4 Asian/Pac. Isl. - 1.9 Other[2] - 46.2

NOTE: [1]Numbers do not total to 100.0 due to rounding.

[2]The category 'Other' includes races which do not fall into the four categories provided on census surveys. All categories listed may include Hispanics.

Source: U.S. Census of Population and Housing, 1990

TABLE 3.2-3 Facility and Economic Data of Marine-Related Businesses at the Five Moveable Bridges

BRIDGE	LOCATION	NO.	PROJECTIONS					
			Slips	Moorings	Total	Winter Storage	Employees, Peak Summer	Annual Revenues ($m)
Connecticut River[1]	Upstream	29	2,609	372	2,981	2,911	218	15.8
	Downstream	2	200	0	200	200	19	1.1
Total		31	2,809	372	3,181	3,111	237	16.9
Niantic River[2]	Upstream	8	787	376	1,163	1,387	67	4.5
	Downstream	0	0	0	0	0	0	0
Total		8	787	376	1,163	1,387	67	4.5
Shaw's Cove[3]	Upstream	1	286	0	286	350	12	-
Thames River[4]	Upstream	4	544	16	560	288	44	1.7
	Downstream	4	345	120	465	153	27	1.1
Total		8	889	136	1,025	441	71	2.8
Mystic River[5]	Upstream	7	388	0	388	765	86	2.2
	Downstream	9	1,613	327	1,940	1,693	132	5.6
Total		16	2,001	327	2,328	2,458	216	7.8

Notes: [1]Facility projections based on the following sample sizes: 21/29 upstream; 2/2 downstream. Economic projections are based on the following sample sizes: 14/29 upstream; 2/2 downstream.
[2]Facility projections based on the following sample sizes: 6/8 upstream; [N.A.] downstream. Economic projections are based on the following sample sizes: 5/8 upstream; [N.A.] downstream.
[3]Economic data suppressed to protect confidentiality of marina owner.
[4]Facility projections based on the following sample sizes: 2/4 upstream; 3/4 downstream. Economic projections are based on the following sample sizes: 2/4 upstream; 2/4 downstream.
[5]Facility projections based on the following sample sizes: 7/7 upstream; 8/9 downstream. Economic projections are based on the following sample sizes: 4/7 upstream; 5/9 downstream.

Source: DMJM/Harris, 1994

TABLE 3.3-1 Status of Historic Resources in the Project Area - Connecticut

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Strouse Corset Factory	New Haven, CT	72.90	Recommended eligible
Grand Avenue Bridge (Bridge No. 3874)	New Haven, CT	72.94	Determined eligible
Olive Street Bridge (Bridge No. 3752)	New Haven, CT	73.08	Determined eligible
Mill River Railroad Bridge	New Haven, CT	73.72	Recommended eligible
Humphrey Street Railroad Bridge	New Haven, CT	73.85	Recommended eligible
Ferry Street Bridge (Bridge No. 3998)	New Haven, CT	74.38	Determined eligible
Clifton St. Railroad Bridge (Bridge No. 3879)	New Haven, CT	76.24	Determined eligible
New Haven Tunnel	New Haven, CT	76.64	Recommended eligible
Branford Center Historic District	Branford, CT	82.40	Listed
Route 146 Historic District	Guilford, CT	85.41	Listed
Island Creek Railroad Bridge	Guilford, CT	87.27	Recommended eligible
Guilford Historic Town Center Historic District	Guilford, CT	88.43	Listed
East River/Post Road Historic District	Madison, CT	90.90	Recommended eligible
Greek Revival-Style House	Madison, CT	93.40	Recommended eligible
Railroad Avenue Historic District	Madison, CT	96.85	Recommended eligible
Jonathan Murray House	Madison, CT	94.00	Listed
Eighteenth-Century House	Clinton, CT	95.50	Recommended eligible
Pond's Extract Company Factory (Cheseborough Ponds)	Clinton, CT	96.75	Recommended eligible
Clinton Station	Clinton, CT	96.60	Recommended eligible
High Street Historic District	Clinton, CT	96.89	Recommended eligible
Indian River Cemetery	Clinton, CT	96.93	Recommended eligible
Indian River Railroad Bridge	Clinton, CT	97.04	Recommended eligible
Liberty Street Historic District	Clinton, CT	97.49	Recommended eligible
Eighteenth-Century House	Westbrook, CT	101.11	Recommended eligible
Patchogue River Railroad Bridge	Westbrook, CT	101.22	Recommended eligible

Table 3.3-1 **Status of Historic Resources in the Project Area - Connecticut** (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Westbrook Station	Westbrook, CT	101.35	Recommended eligible
Old Saybrook Station And Freight House	Old Saybrook, CT	105.04	Recommended eligible
Old Saybrook Interlocking Tower	Old Saybrook, CT	105.08	Recommended eligible
Connecticut River Railroad Bridge	Old Saybrook, CT	106.89	Determined eligible
Eighteenth-Century House	Old Lyme, CT	108.51	Recommended eligible
Rocky Neck Park Pavilion	Old Lyme, CT	112.70	Listed
Rocky Neck Park Trail Bridge	Old Lyme, CT	112.74	Listed as part of Park Pavilion
Bride Brook Railroad Bridge	East Lyme, CT	113.18	Recommended eligible
Morton House	East Lyme, CT	115.90	Recommended eligible
Niantic River Railroad Bridge	East Lyme, CT	116.74	Determined eligible
Victorian Stone House	Waterford, CT	119.80	Recommended eligible
J.N. LaPointe Tool Company	New London, CT	121.90	Recommended eligible
Downtown New London Historic District	New London, CT	122.70	Listed
New London Railroad Station	New London, CT	122.75	Listed
Connecticut Power Company Power Plant	New London, CT	123.30	Recommended eligible
Central Vermont Roundhouse	New London, CT	123.75	Recommended eligible
Central Vermont Railroad Bridge	New London, CT	123.80	Recommended eligible
Thames River Railroad Bridge	New London, CT	124.09	Determined eligible
Groton Tower	Groton, CT	124.40	Recommended eligible
Haley Farm Historic Rural Landscape	Groton, CT	129.30	Recommended eligible
Noank Historic District	Groton, CT	129.60	Listed
Noank Cove Railroad Bridge	Groton, CT	130.63	Recommended eligible
Fitch House	Groton, CT	131.37	Recommended eligible
Mystic River Historic District	Groton, CT	131.30	Listed
Mystic Bridge Historic District	Stonington, CT	132.60	Listed
Wilcox Road Historic District	Stonington, CT	133.77	Recommended eligible
Stonington Borough Historic District	Stonington, CT	136.10	Listed

Table 3.3-1 Status of Historic Resources in the Project Area - Connecticut (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Mechanic Street (Pawcatuck) Historic District	Stonington, CT	140.50	Listed
Campbell Grain Mill	Stonington, CT	141.30	Recommended eligible
Pawcatuck River Railroad Bridge	Stonington, CT	141.35	Determined eligible (structural integrity questionable)

Source: HRC, 1994

TABLE 3.3-2 Status of Historic Resources in the Project Area - Rhode Island

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Pawcatuck River Railroad Bridge	Westerly, RI	141.35	Determined eligible (structural integrity questionable)
Westerly Railroad Station	Westerly, RI	141.60	Listed
Westerly Freight Station	Westerly, RI	141.62	Recommended eligible
Downtown Westerly Historic District	Westerly, RI	141.50	Listed
Westerly Armory	Westerly, RI	141.65	Recommended eligible
West Street Bridge (RIDOT No. 401)	Westerly, RI	141.67	Determined eligible
Greek Revival-Style House	Westerly, RI	141.67	Recommended eligible
Immaculate Conception Church	Westerly, RI	141.77	Listed
Westerly Signal Tower	Westerly, RI	142.05	Recommended eligible
Greek Revival-Style House	Westerly, RI	142.00	Recommended eligible
Eighteenth-Century House	Westerly, RI	144.60	Recommended eligible
Stone-Walled Enclosure	Westerly, RI	144.60	Recommended eligible
Bradford Historic District	Westerly, RI	145.50	Determined eligible
Pawcatuck River Railroad Bridge	Westerly, RI	146.39	Recommended eligible
Pawcatuck River Railroad Bridge	Charlestown, RI	147.45	Recommended eligible
Pawcatuck River Railroad Bridge	Charlestown, RI	149.47	Recommended eligible
Pawcatuck River Railroad Bridge	Charlestown, RI	150.59	Recommended eligible
Pawcatuck River Railroad Bridge	Charlestown, RI	152.71	Recommended eligible
Victorian-Period House	Richmond, RI	150.00	Recommended eligible
Greek Revival-Style House	Richmond, RI	150.10	Recommended eligible
Shannock Historic District	Richmond, RI	152.90	Listed
Kenyon Historic District	Richmond, RI	154.00	Recommended eligible
Kingston Railroad Station	South Kingston, RI	158.20	Listed
Main Street Bridge (RIDOT No.372)	South Kingston, RI	158.32	Recommended eligible
Kingston Tower	South Kingston, RI	158.35	Recommended eligible
Washington County Courthouse	South Kingston, RI	158.40	Recommended eligible

Table 3.3-2 **Status of Historic Resources in the Project Area - Rhode Island** (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
West Kingston Historic Rural Landscape	South Kingston, RI	158.50	Recommended eligible
Kenyon Homestead/Underwood House	South Kingston, RI	158.70	Recommended eligible
Hundred Acre Pond Railroad Bridge	South Kingston, RI	159.37	Recommended eligible
Yawgoo Mill And Company Houses	Exeter, RI	161.50	Recommended eligible
W. R. Slocum House	North Kingston, RI	162.00	Recommended eligible
Sod Farm Landscape At Slocum	North Kingston, RI	162.30	Recommended eligible
Wickford Junction/Lafayette Historic District	North Kingston, RI	165.80	Listed
Lawton Farm Landscape	North Kingston, RI	166.80	Recommended eligible
Lawton House	North Kingston, RI	166.85	Recommended eligible
Hunt's River Road Bridge (RIDOT No. 7)	North Kingston, RI	169.79	Recommended eligible
Pains Pond Railroad Culvert	East Greenwich, RI	171.06	Recommended eligible
East Greenwich Historic District	East Greenwich, RI	171.80	Listed
Elizabeth Spring	Warwick, RI	171.00	Listed
Post Road Historic District	Warwick, RI	172.35	Recommended eligible
Ocean Point Road Railroad Bridge	Warwick, RI	172.75	Recommended eligible
Rhode Island Historical Cemetery No. 34	Warwick, RI	174.50	Recommended eligible
Victorian-Period House	Warwick, RI	174.70	Recommended eligible
Greenwood Railroad Bridge (RIDOT #2)	Warwick, RI	175.70	Recommended eligible
Greenwood Inn	Warwick, RI	175.70	Recommended eligible
Pontiac Railroad Station	Warwick, RI	176.20	Recommended eligible
Elizabeth Mill	Warwick, RI	176.70	Recommended not eligible
Pawtuxet River Railroad Bridge	Cranston, RI	179.16	Recommended eligible
Maxwell Briscoe Motor Company/Universal Winding Company	Cranston, RI	179.25	Recommended eligible
United Traction Depot and Repair Shop	Cranston, RI	182.70	Recommended eligible
General Electric Company	Providence, RI	180.35	Recommended eligible

Table 3.3-2 **Status of Historic Resources in the Project Area - Rhode Island** (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Gorham Manufacturing Company, Carriage House and Stable	Providence, RI	181.70	Recommended eligible
Union Railroad Co. Car Barns and Stable	Providence, RI	181.90	Recommended eligible
Potters Avenue Historic District	Providence, RI	182.00	Recommended eligible
Atlantic Coal Company Storage Elevators	Providence, RI	183.20	Recommended eligible
Weybosset Mills	Providence, RI	183.55	Recommended eligible
Power Plant	Providence, RI	183.50	Recommended eligible
Commercial Building	Providence, RI	183.55	Recommended eligible
City Machine Company	Providence, RI	184.50	Recommended eligible
Merchants Cold Storage and Warehouse Co.	Providence, RI	184.90	Determined eligible
Downtown Providence Historic District	Providence, RI	184.90	Listed
Brown & Sharpe Manufacturing Company	Providence, RI	185.10	Determined eligible
University of R.I. Extension Building	Providence, RI	185.30	Recommended eligible
Old Union Station	Providence, RI	185.40	Listed
Rhode Island State House	Providence, RI	185.70	Listed
Roger Williams National Memorial Park	Providence, RI	185.70	Listed
Cathedral Of St. John	Providence, RI	185.70	Listed
Rhode Island State Office Building	Providence, RI	185.80	Recommended eligible
College Hill Historic District	Providence, RI	185.00	Listed
Moshassuck Square Historic District	Providence, RI	186.00	Listed
Oriental Mills	Providence, RI	186.20	Recommended eligible
Silver Spring Bleaching and Dying Co.	Providence, RI	186.60	Recommended eligible
Providence Tool Company	Providence, RI	186.70	Recommended eligible
Box Factory/Ginger Ale Plant	Providence, RI	186.85	Recommended eligible
North Burial Ground	Providence, RI	187.00	Listed
Northrup Yard	Pawtucket, RI	187.80	Recommended eligible
Colfax Tower	Pawtucket, RI	187.70	Recommended eligible

Table 3.3-2 Status of Historic Resources in the Project Area - Rhode Island (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
American Textile Company	Pawtucket, RI	187.80	Recommended eligible
Hope Webbing Company	Pawtucket, RI	188.00	Recommended eligible
Blackstone Canal	Pawtucket, RI	188.27	Listed
Woodlawn Signal Tower	Pawtucket, RI	189.10	Recommended eligible
Mineral Spring Cemetery	Pawtucket, RI	189.20	Recommended eligible
Mineral Spring Park	Pawtucket, RI	189.20	Listed
Conant Thread Complex	Pawtucket, RI	189.20	Listed
Pawtucket Freight Station	Pawtucket, RI	189.40	Recommended eligible
Union Wadding	Pawtucket, RI	189.50	Recommended eligible
Former School	Pawtucket, RI	189.60	Recommended eligible
Italianate-Style House	Pawtucket, RI	189.80	Recommended eligible
Pawtucket/Central Falls Station	Pawtucket, RI	189.80	Recommended eligible
Blackstone River Railroad Bridge	Pawtucket, RI	190.55	Recommended eligible
Pumping Station No. 1	Pawtucket, RI	190.65	Recommended eligible
Pumping Station No. 4	Pawtucket, RI	190.65	Recommended eligible
South Central Falls Historic District	Central Falls, RI	189.90	Listed
Central Falls Congregational Church (now St. Joseph's Parish Hall)	Central Falls, RI	189.90	Listed
St. Joseph's Church	Central Falls, RI	189.90	Recommended eligible
Victorian-Period House	Central Falls, RI	189.90	Recommended eligible
Norton House	Central Falls, RI	189.90	Recommended eligible
Italianate-Detailed House	Central Falls, RI	190.00	Recommended eligible
Greene House	Central Falls, RI	190.00	Listed
Flagg House	Central Falls, RI	190.90	Recommended eligible
Central Street Pedestrian Viaduct	Central Falls, RI	190.00	Recommended eligible
Grant House	Central Falls, RI	190.00	Recommended eligible
Crocker House	Central Falls, RI	190.00	Recommended eligible

Table 3.3-2 Status of Historic Resources in the Project Area - Rhode Island (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Wood House	Central Falls, RI	190.00	Recommended eligible
Fales House	Central Falls, RI	190.20	Recommended eligible
Boston Switch Tower	Central Falls, RI	190.30	Recommended eligible
Fales and Jenks Mill	Central Falls, RI	190.30	Recommended eligible
High Street Railroad Bridge	Central Falls, RI	190.49	Recommended eligible

Source: HRC, 1994

TABLE 3.3-3 Status of Historic Resources in the Project Area - Massachusetts

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Howard Bullock Textile Machine Factory	Attleboro, MA	190.75	Recommended eligible
Seven Mile River Railroad Bridge	Attleboro, MA	192.76	Recommended eligible
Hebronville Mill Historic District	Attleboro, MA	193.75	Listed
Dodgeville Mill Historic District	Attleboro, MA	195.55	Determined eligible
Dodgeville Mill Tailrace Railroad Culvert	Attleboro, MA	195.55	Recommended eligible
Ten Mile River Railroad Culvert	Attleboro, MA	195.58	Recommended eligible
Ten Mile River Railroad Bridge	Attleboro, MA	196.59	Recommended eligible
First Parsonage for Second Parish Church	Attleboro, MA	197.00	Listed
East Attleboro Academy	Attleboro, MA	197.30	Listed
South Main Street Railroad Bridge	Attleboro, MA	197.13	Recommended eligible
Attleboro Stations	Attleboro, MA	197.15	Listed
D.E. Makepeace Company	Attleboro, MA	197.20	Listed
Mill Street Railroad Bridge	Attleboro, MA	197.21	Recommended eligible
Attleboro Post Office	Attleboro, MA	197.35	Listed
Park Street Railroad BridgE	Attleboro, MA	197.38	Recommended eligible
Attleboro Tower	Attleboro, MA	197.40	Recommended eligible
Peck Street Railroad Bridge	Attleboro, MA	197.64	Recommended eligible
Wading River Railroad Bridge	Mansfield, MA	200.66	Recommended eligible
Chilson Iron Foundry	Mansfield, MA	204.35	Recommended eligible
Lowney Chocolate Factory	Mansfield, MA	204.85	Recommended eligible
Victorian-Period House	Foxboro, MA	206.40	Recommended eligible
Capt. Josiah Pratt House (Pratt Mansion)	Foxboro, MA	206.50	Listed
"The Homestead"	Sharon, MA	210.00	Recommended eligible
Sharon Historic District	Sharon, MA	211.00	Listed
Sharon Station	Sharon, MA	210.50	Recommended eligible
Sharon Water Works	Sharon, MA	211.10	Recommended eligible

TABLE 3.3-3. STATUS OF HISTORIC RESOURCES IN THE PROJECT AREA - MASSACHUSETTS (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Maskwonicut Street Bridge (stone arch)	Sharon, MA	211.62	Recommended eligible
John Savels House	Sharon, MA	211.80	Recommended eligible
Darius Lothrup House	Sharon, MA	211.90	Recommended eligible
Neponset Cotton Mill	Canton, MA	213.70	Determined eligible (structural integrity questionable)
Canton Viaduct	Canton, MA	213.74	Listed
Canton Junction Station	Canton, MA	214.10	Recommended eligible
Spragues Brook Railroad Bridge	Dedham, MA	218.57	Recommended eligible
Franklin Branch Bridge	Boston, MA	219.41	Recommended eligible
B. F. Sturtevant Company (Westinghouse Fan and Bearing Plant)	Boston, MA	220.10	Recommended eligible
Dedham Manufacturing District	Boston, MA	219.50	Recommended eligible
Christ Church	Boston, MA	220.60	Listed
Hyde Park Public Library	Boston, MA	220.70	Recommended eligible
Webster Square Historic District	Boston, MA	220.70	Recommended eligible
Haleyville Historic District	Boston, MA	220.80	Recommended eligible
Hyde Park Pumping Station	Boston, MA	221.80	Recommended eligible
Woodbourne Historic District	Boston, MA	223.00	Recommended eligible
Mt. Hope Footbridge	Boston, MA	223.31	Recommended eligible
Arnold Arboretum	Boston, MA	223.65	Listed
Sumner Hill Historic District	Boston, MA	224.20	Recommended eligible
Green Street Manufacturing District	Boston, MA	224.50	Recommended eligible
Glenvale Park Historic District	Boston, MA	224.60	Recommended eligible
Amory Street Workers' Housing	Boston, MA	224.65	Recommended eligible
Franklin Park	Boston, MA	224.70	Listed
Haffenreffer Brewery	Boston, MA	224.80	Listed
Hyde Square Historic District	Boston, MA	225.10	Recommended eligible

TABLE 3.3-3. STATUS OF HISTORIC RESOURCES IN THE PROJECT AREA - MASSACHUSETTS (continued)

NAME OF RESOURCE	MUNICIPALITY	MILEPOST	NATIONAL REGISTER STATUS
Parker Hill/Mission Hill North Slope Historic District	Boston, MA	225.50	Recommended eligible
Roxbury Highlands Historic District	Boston, MA	225.55	Listed
Dudley Mansion	Boston, MA	225.65	Determined eligible
Stony Brook Breweries	Boston, MA	225.70	Recommended eligible
South End Historic District	Boston, MA	226.80	Listed
Saint Botolph Street Historic District	Boston, MA	226.95	Determined eligible
Cahners Building	Boston, MA	227.60	Recommended eligible
Youth's Companion Building	Boston, MA	227.65	Listed
Armory of the First Corps of Cadets	Boston, MA	227.80	Listed
Bay Village Historic District	Boston, MA	227.80	Recommended eligible
Fort Point Channel Railroad Bridge	Boston, MA	228.70	Recommended eligible
South Station	Boston, MA	229.20	Listed

Source: HRC, 1994

TABLE 3.4-1 Summary of Existing Noise Measurement Results

SITE	ADDRESS	START DATE AND TIME	DIST. TO NEAR TRACK CENTER (ft)	L_{dn} (dBA)	24-HOUR L_{eq} (dBA)	MAX. HOURLY L_{eq} (dBA)	MIN. HOURLY L_{90} (dBA)	RANGE OF L_{max} FOR TRAINS (dBA)
A-1	135 First Ave. New Haven, CT	11/04/92 12:00 PM	88	69	64	73	39	79-103
A-2	176 Westbrook Heights Rd. Westbrook, CT	11/03/92 04:00 PM	105	68	63	69	44	75-94
A-3	21 Gunshot Rd. Waterford, CT	11/02/92 02:00 PM	80	68	62	67	37	79-97
A-3a	500 Noank Rd. W. Mystic, CT	11/05/92 02:35 PM	35	–	–	–	–	90-114
A-4	8 Wilford Ct. Pawcatuck, CT	11/02/92 06:00 PM	73	77	73	79	41	83-112
A-5	36 Railroad St. Charlestown, RI	10/29/92 04:00 PM	57	68	61	70	25	78-103
A-6	88 Alger St. Warwick, RI	10/29/92 06:00 PM	63	72	65	74	35	76-107
A-7	11 Foundry St. Central Falls, RI	10/28/92 04:00 PM	25	74	68	74	47	81-100
A-8	38 Otis St. W. Mansfield, MA	10/29/92 01:00 PM	50	72	66	71	30	72-100
A-9	20 Hartwell Pl. Canton, MA	10/27/92 01:00 PM	60	73	67	72	44	78-99
A-10	2 Westminster St. Hyde Park, MA	10/27/92 11:00 AM	70	74	68	73	36	74-98

Source: HMMH, 1993

TABLE 3.4-2 Existing Ground Vibration Measurement Summary

SITE	ADDRESS	START DATE AND TIME	END DATE AND TIME	DIST. TO NEAR TRACK CENTER (ft)	NUMBER OF TRAINS MEAS.	RANGE OF MAXIMUM VIBRATION VELOCITY LEVEL FOR TRAINS (dB re 1 μ-in/sec)
A-1	135 First Ave. New Haven, CT	11/05/92 08:15 AM	11/05/92 11:59 AM	88	10	65-86
A-2	176 Westbrook Heights Rd. Westbrook, CT	11/04/92 01:27 PM	11/04/92 04:46 PM	105	8	65-76
A-3	21 Gunshot Rd. Waterford, CT	11/02/92 01:56 PM	11/02/92 05:17 PM	80	6	82-86
A-3a	500 Noank Rd. W. Mystic, CT	11/05/92 02:35 PM	11/05/92 05:01 PM	35	5	76-82
A-4	8 Wilford Ct. Pawcatuck, CT	11/03/92 10:10 AM	11/03/92 12:47 PM	73	5	81-87
A-5	36 Railroad St. Charlestown, RI	10/30/92 02:37 PM	10/30/92 05:07 PM	57	5	88-92
A-6	88 Alger St. Warwick, RI	10/30/92 09:05 AM	10/30/92 12:26 PM	63	7	86-94
A-7	11 Foundry St. Central Falls, RI	10/29/92 02:09 PM	10/29/92 05:21 PM	25	10	86-95
A-8	38 Otis St. W. Mansfield, MA	10/29/92 08:16 AM	10/29/92 11:50 AM	119	11	68-74
A-9	20 Hartwell Pl. Canton, MA	10/27/92 01:48 PM	10/27/92 05:09 PM	60	10	60-70
A-10	2 Westminster St. Hyde Park, MA	10/28/92 08:00 AM	10/28/92 11:00 AM	70	21	78-87

Source: HMMH, 1994

TABLE 3.5-1 Population Categories Potentially Exposed to Project-Induced EMF

POPULATION TYPE	LOCATION/DESCRIPTION	EMF EXPOSURE CATEGORY
Residential[1]	People in residences located:	
Zone 1	0-50 ft from edge of rail or substation	Environmental
Zone 2	50-100 ft from edge of rail or substation	Environmental
Zone 3	100-150 ft from edge of rail or substation	Environmental
Commercial/Industrial	Employees of businesses located:	
Zone 1	0-50 ft from edge of rail or substation	Occupational
Zone 2	50-100 ft from edge of rail or substation	Occupational
Zone 3	100-150 ft from edge of rail or substation	Occupational
Recreational	People utilizing parks located:	
Zone 1	0-50 ft from edge of rail	Occasional
Zone 2	50-100 ft from edge of rail	Occasional
Zone 3	100-150 ft from edge of rail	Occasional
Amtrak/ConnDOT Employees	Employees who work:	
Zone 1	On the train	Occupational
Zone 2	Along the ROW	Occupational
Zone 3	At stations	Occupational
MBTA/Freight Employees	Employees who work:	
On-train	On the train	Occasional[2]
Off-train	Along the ROW	Occasional[2]
Amtrak/ConnDOT/ RIDOT/MBTA Passengers	On the train	Occasional[3]

Notes: [1]This population type is subdivided into adults and children for certain aspects of the EMF impact analysis. Age is the only distinguishing factor between the two subcategories.

[2]Since MBTA and freight trains will continue to use diesel fuel, employees will encounter magnetic fields from the NEC electrification project only when passing under or working under an energized catenary section.

[3]Amtrak, RIDOT, and ConnDOT passengers will encounter magnetic fields from the NEC electrification project during the duration of their trips. MBTA passengers will encounter magnetic fields from the NEC electrification only when MBTA trains pass under an energized catenary section.

Source: Roy F. Weston, Inc., 1994

TABLE 3.5-2 Summary of Estimates of Total Potentially Exposed Persons Along ROW Categorized by Distance From EMF Source and By Population Type

POPULATION TYPE	POPULATION WITHIN EACH ZONE			
	Exposure Zone 1[1]	Exposure Zone 2[2]	Exposure Zone 3[3]	Totals
Residential - Wayside				
Existing (1993)	300	6,600	1,300	8,200
Projected (2010)	300	7,000	1,400	8,700
Residential - Tie-Line Substation				
Existing (1993)	37	12	7	56
Projected (2010)	37	12	7	56
Commercial/Industrial - Wayside				
Existing (1993)	2,600	18,500	18,500	39,500
Projected (2010)	2,800	20,000	20,800	42,700
Commercial/Industrial - Tie-Line/Substation				
Existing (1993)	8	170	171	349
Projected (2010)	12	184	185	381
Recreational				
Existing (1993)	17,000	17,000	17,000	51,000
Projected (2010)	18,000	18,000	18,000	54,000
Amtrak, ConnDOT, and MBTA Employees[4]				
On-train	250			250
Off-train	560[5]	160[6]		720
Freight Employees				
On-train	18			18
Average NEC Rail Ridership, per day[7] (2010)	40,300			40,300

Notes: [1]0 to 50 ft. from edge of rail (0 to 20 ft. from edge of ROW).
[2]50 to 100 ft. from edge of rail (20 to 70 ft. from edge of ROW).
[3]100 to 150 ft. from edge of rail (70 to 120 ft. from ROW).
[4]Current estimates; projected estimates not currently developed by rail agencies.
[5]Yard, rail, and maintenance workers.
[6]Station and management workers.
[7]Includes Amtrak, MBTA, RIDOT, and ConnDOT.

Source: Roy F. Weston, Inc., 1994

TABLE 3.7-1 Environmental Attributes Contributing to Prehistoric Archaeological Sensitivity Rankings

CRITERIA	HIGH	MODERATE	LOW
Distance to Water/Wetland	adjacent or <150 m	150 to 300 m	>300 m
Slope	minimal 0 to 3%	moderate 3 to 15%	steep >15%
Soil Types	sandy, well-drained	gravelly, fair drainage	very gravelly, poor drainage

Source: PAST, Inc., 1993

TABLE 3.7-2 Locational Attributes Contributing to Historic Period Site Distribution

CRITERIA	HIGH SENSITIVITY	MODERATE SENSITIVITY	LOW SENSITIVITY
Known historic sites in vicinity	known site adjacent or near	known site in general vicinity	no known sites in vicinity
Proximity to fresh water source	adjacent or <100 m	moderate 100 to 300 m	distant >300 m
Proximity to water power source	adjacent or <50 m	moderate 50 to 150 m	distant >150 m
Access to transportation network	excellent <200 m	moderate 200 to 1500 m	distant >1500 m
Proximity to settlement concentration	adjacent or <800 m	moderate 800 to 1500 m	distant >1500 m
Proximity to agriculture	adjacent or <100 m	moderate 100 to 300 m	distant >300 m
Disturbance	none to minimal	minimal to moderate	moderate to severe

Source: PAST, Inc., 1993

TABLE 3.7-3 Archaeological Sensitivity of Substation Sites and Utility Corridor

SUBSTATION	LOCATION	MILE POST	ARCHAEOLOGICAL SENSITIVITY	LEVEL OF ARCHAEOLOGICAL SURVEY
Branford	Branford, CT	79.26	Substation - low Corridor - low	assessment assessment and locational (Phase I Reconnaissance Survey)
New London	New London, CT	123.55	Substation - low Corridor - moderate	assessment
Warwick	Warwick, RI	176.91	Substation - low Corridor - low	assessment
Roxbury Crossing	Boston, MA	226.02	Substation - low Corridor - low	assessment (reconnaissance)

Source: PAST, Inc., 1994

TABLE 3.7-4 Archaeological Sensitivity of Switching Station Sites

SWITCHING STATIONS	LOCATION	MILE POST	ARCHAEOLOGICAL SENSITIVITY	RECOMMENDED ACTION
Westbrook	Westbrook, CT	103.53	Low	None
Richmond	Richmond, RI	150.35	Low	None
Norton	Attleboro, MA	198.99	Low	None

Source: PAST, Inc., 1994

TABLE 3.7-5 Archaeological Sensitivity of Paralleling Station Sites

PARALLELING STATION	LOCATION	MILE POST	ARCHAEOLOGICAL SENSITIVITY	LEVEL OF ARCHAEOLOGICAL SURVEY
Leetes Island	Guilford, CT	85.99	Low	assessment and locational (Phase I Reconnaissance)
Madison	Madison, CT	92.41	Low	assessment and locational (Phase I Reconnaissance)
Grove Beach	Westbrook, CT	99.11	Low	assessment
Old Lyme	Old Lyme, CT	109.50	Low	assessment and locational (Phase I Reconnaissance)
Millstone	Waterford, CT	117.54	Low	assessment
Noank	Groton, CT	129.52	Low	assessment
Stonington	Stonington, CT	134.65	Low	assessment and locational (Phase I Reconnaissance)
State Line	Stonington, CT	139.93	Low	assessment and locational (Phase I Reconnaissance)
Bradford	Westerly, RI	145.19	Low	assessment
Kingston	South Kingstown, RI	157.11	Low	assessment and locational (Phase I Reconnaissance)
Exeter	Exeter, RI	161.78	Low	assessment
East Greenwich	North Kingstown, RI	169.80	Low	assessment
Elmwood	Providence, RI	181.49	Low	assessment
Providence	Pawtucket, RI	187.45	Low	assessment
Attleboro	Attleboro, MA	193.40	Low	assessment (reconnaissance) and locational (Intensive)
East Foxboro	Foxboro, MA	205.70	Low	assessment (reconnaissance) and locational (Intensive)
Canton	Sharon, MA	212.38	Low	assessment (reconnaissance) and locational (Intensive)
Readville	Boston, MA	219.08	Low	assessment (reconnaissance)

Source: PAST, Inc., 1994

TABLE 3.7-6 Archaeological Sensitivity at Bridges to be Modified

BRIDGE NAME	LOCATION	MILE POST	ARCHAEOLOGICAL SENSITIVITY	LEVEL OF ARCHAEOLOGICAL SURVEY
Johnnycake Hill Road	Old Lyme, CT	108.51	Low	assessment and locational (Phase I Reconnaissance)
Millstone Point Road	Waterford, CT	117.31	Low	assessment
Burdickville Road	Charlestown, RI	148.41	Low	assessment and locational (Phase I Reconnaissance)
Kenyon School Road	Richmond, RI	154.04	Low	assessment and locational (Phase I Reconnaissance)
Pettaconsett Avenue	Warwick, RI	178.46	Low	assessment
Park Avenue	Cranston, RI	180.29	Low	assessment
Maskwonicut Street	Sharon, MA	211.62	Low	assessment (reconnaissance) and locational (Intensive)

Source: PAST, Inc., 1993

TABLE 3.8-1 Characteristics of Existing Grade Crossings

CROSSING	STATUS	MILE POST	SPEED LIMIT (MPH)	TRAFFIC CONTROL DEVICES[1]	NO. OF LANES	DAILY TRAFFIC VOLUME	NO. COLLISIONS IN LAST 5 YEARS	SETTING
Chapman's Crossing	Private	112.19	60	none	1	N/A[2]	0	Suburban, vehicular emergency access
Miner Lane	Public	120.20	60	G-L-B	2	900	0	Rural
Bank Street	Public	122.50	25	G-L-B	2	200	0	Urban
State Street	Public	122.76	25	G-L-B	2	500	0	Urban
Gov. Winthrop Blvd.	Public	123.01	25	G-L-B	2	2,470	0	Urban
School Street	Public	131.50	70	G-L-B	2	900	1	Urban
Broadway Extens.	Public	132.30	50	G-L-B	2	1,220	0	Urban
Latimer Point	Public	133.40	70	G-L-B	2	370	0	Suburban
Wamphassuc	Public	134.90	60	G-L-B	2	310	0	Suburban
Chesebrough	Private	136.50	70	none	1	N/A[2]	0	Urban
Walkers Dock	Private	136.65	70	G-L-B	1	N/A[2]	0	Urban
Freeman's	Private	136.70	70	G-L-B	1	N/A[2]	0	Urban
Palmer Street	Public	140.55	80	G-L-B	2	1,650	0	Rural
Caro's	Private	143.70	80	none	1	N/A[2]	0	Rural
Wolf Rocks Road	Public	160.30	100	G-L-B	2	N/A[3]	0	Rural
Lazy Lady Farm	Private	198.96	95	none	1	N/A[2]	0	Rural

Notes: [1]G=gate, L=flashing lights, B=bells
[2]Private road; traffic volume not available
[3]Programmed to be grade-separated in 1993

Source: Amtrak, DMJM/Harris, 1994

TABLE 3.8-2 Pedestrian Crossings in Connecticut

LOCATION	MILEPOST	MUNICIPALITY	FENCING	NUMBER OF TRACKS	SPEED LIMIT (MPH)
Railroad Avenue	92.80	Madison	no	2	90
Privateer LTD	96.00	Clinton	partial	2	85
N. Broadway	99.20	Westbrook	partial	2	85
Westbrook Heights Road	101.30	Westbrook	no	2	90
Boston Post Road	105.20	Old Saybrook	no	2	90
Near Shore Road	107.60	Old Lyme	no	2	75
Rocky Neck State Park	112.65	East Lyme	yes (break)	2	60
Ridgewood Drive	113.80	East Lyme	no	2	75
Gada Road	114.80	East Lyme	no	2	75
Near MP 115.80	115.80	East Lyme	yes (break)	2	75
Hole in the Wall Beach	115.90	East Lyme	partial	2	70
Grand Street	116.20	East Lyme	yes (break)	2	75
Near Niantic River Bridge	116.70	East Lyme	partial	2	60
Haley Farm State Park	128.30	Groton	no	2	70
Spicer Avenue	130.40	Groton	no	2	70
Near MP 136.2	136.20	Stonington	no	2	50

Source: DMJM/Harris, 1994

TABLE 3.8-3 Pedestrian Crossings in Rhode Island

LOCATION	MILEPOST	MUNICIPALITY	FENCING	NUMBER OF TRACKS	SPEED LIMIT (MPH)
Old Baptist Road	168.50	North Kingstown	no	2	95
Rocky Hollow Road	170.00	Warwick	no	2	95
Queen Street	171.50	Warwick	no	2	95
Alger Avenue	172.90	Warwick	no	2	85
Folly Landing	173.90	Warwick	no	2	85

Source: DMJM/Harris, 1994

TABLE 3.8-4 Pedestrian Crossings in Massachusetts

LOCATION	MILEPOST	MUNICIPALITY	FENCING	NUMBER OF TRACKS	SPEED LIMIT (MPH)
Knight Street	193.70	Hebronville	no	2	100
Oak Street	197.78	Attleboro	yes	2	100
Morse/Summer Place	206.00	East Foxboro	yes	2	95
Manomet Street	208.20	Sharon	no	2	95
Garden Street	209.52	Sharon	partial	4	95
Mohawk Street	209.50	Sharon	no	2	95
Dale Street	221.85	Hyde Park	yes	3	100
Grew Avenue	222.00	Roslindale	yes	3	100

Source: DMJM/Harris, 1994

TABLE 3.8-5 Station Characteristics and Pedestrian Access at Railroad Stations

STATION	NO. OF TRACKS	PLATFORM	PASSENGER ACCESS	FENCING[1]	TYPE SERVICE[2]	AMTRAK SPEED (MPH)	
						1992	2010
New Haven	4	High level	Pedestrian underpass	N/A	B	N/A[4]	N/A[4]
Branford, Guilford, Madison, Clinton, Westbrook	2	Short, low level, outside one track only	Across tracks at grade	FS	C	50-90	105-150
Old Saybrook	2	Short, low level, outside one track only	Across tracks at grade	FS	B	90	120
New London	3	Full length, low level, outside all tracks	State St. public grade crossing	I	A	25	60
Mystic	2	Full length, low level, outside both tracks	Broadway public grade crossing	I	A	70	75
Westerly	2	Full length, low level, outside both tracks	Pedestrian tunnel to westbound track	I	A	75	100
Kingston	2	Low level, outside eastbound track; narrow low level between tracks on westbound side	Across tracks at grade	None	A	100 wb[3] 80 eb	150
Providence	4	Full length, high level, outside all tracks	Direct from terminal	N/A	B	N/A[4]	N/A[4]
South Attleboro	2	Full length, low level, outside both tracks[5]	Pedestrian overpass to eastbound track	I	C	100 wb 95 eb	150
Attleboro	3	Full length, low level, outside both tracks[5]	Underpass on adjacent streets	I	C	95 wb 100 eb	150
Mansfield	2	Full length, low level, outside both tracks[5]	Underpass on adjacent Route 106	I	C	100	150
Sharon	2	Full length, low level, outside both tracks	Depot Street Overpass	I	C	95	140
Canton Junction	2	Full length, low level, outside both tracks	Across tracks at grade	I	C	80	150

TABLE 3.8-5 Station Characteristics and Pedestrian Access at Railroad Stations (continued)

STATION	NO. OF TRACKS	PLATFORM	PASSENGER ACCESS	FENCING[1]	TYPE SERVICE[2]	AMTRAK SPEED (MPH)	
						1992	2010
Route 128	2	Full length, low level, outside both tracks	Pedestrian overpass to eastbound track	I	B	N/A[4]	N/A[4]
Hyde Park	3	Full length, low level, outside both tracks	Overpass on River Street	I	C	100	150
Ruggles	3	Full length, high level between western tracks	Overhead rapid transit station	N/A	C	100	150
Back Bay	3	Full length, high level	Direct from terminal	N/A	B	N/A[4]	N/A[4]
South Station	11	Full length, high level	Direct from terminal	N/A	B	N/A[4]	N/A[4]

Notes: [1]I = Intertrack fencing; FS = Fencing on far side of tracks from the parking/access; BS = Fencing on both sides of tracks.
[2]A = Amtrak service only; B= Both Amtrak and Commuter Service; C = Commuter service only.
[3]wb = Westbound; eb = Eastbound.
[4]Not applicable because all trains stop at this station.
[5]Mini, high level platforms outside both tracks for handicapped access.

Source: Amtrak, DMJM/Harris, 1994

TABLE 3.9-1 Existing Boston-New York City Amtrak Service on the Northeast Corridor[1] via Shore Line

10 WEEKDAY WESTBOUND TRAINS					
TRAIN NUMBER	**TRAIN TYPE**	**NO. OF STOPS**	**DEPART BOSTON**	**ARRIVE NEW HAVEN**	**ARRIVE NEW YORK**
151	Express	4	6:00a	8:34a	10:14a
169	Conven.	8	7:25a	10:24a	12:19p
153	Express	3	9:05a	11:35a	1:15p
171	Conven.	6	9:25a	12:21p	2:20p
173	Conven.	5	11:25a	2:23p	4:21p
175	Conven.	5	1:25p	4:18p	6:17p
177	Conven.	7	3:30p	6:32p	8:25p
179	Conven.	5	4:30p	7:18p	9:10p
193	Conven.	8	7:01p	10:02p	11:54p
67	Conven.	7	10:20p	1:28a	3:16a
10 WEEKDAY EASTBOUND TRAINS					
TRAIN NUMBER	**TRAIN TYPE**	**NO. OF STOPS**	**DEPART NEW YORK**	**DEPART NEW HAVEN**	**ARRIVE BOSTON**
66	Conven.	8	3:15a	5:18a	8:39a
12	Conven.	4	7:01a	9:00a	12:04a
190	Conven.	8	9:30a	11:30a	2:33p
170	Conven.	5	1:30a	1:34p	4:35p
154	Express	3	12:42p	2:14p	4:55p
172	Conven.	7	1:35p	3:44p	6:53p
174	Conven.	6	3:25p	5:21p	8:28p
156	Express	3	4:55p	6:34p	9:08p
176	Conven.	6	5:44p	7:46p	10:47p
178	Conven.	8	7:25p	9:17p	12:26a

Notes: [1]Service continues south.
Express = Express train with reservations required.
Conven. = Conventional train without reservations required.

Source: Amtrak, Northeast Timetable, effective May 1, 1994.

TABLE 3.9-2 Existing Annual Amtrak and Commuter Ridership at Express Stations (on & off in thousands)

STATION	INTERCITY PASSENGERS	COMMUTERS	TOTAL
South Station	897	7,100	7,997
Back Bay	121	4,356	4,477
Route 128	161	815	976
Providence	305	320	625
New Haven	314	1,647	1,961
TOTAL	**1,798**	**14,238**	**16,036**

Source: Amtrak, MBTA, ConnDOT, 1993

TABLE 3.9-3 Daily Railroad Freight Operations

ROUTE SEGMENT	MILE POST LIMITS	MILES	NUMBER OF DAILY TRAINS	
			1993	2010
New Haven - Mill River	72.2-73.7	1.5	2	2
Mill River - Shore Line Junction	73.7-75.2	1.5	3	5
Shore Line Junction - Groton	75.2-124.6	49.4	2	4
Groton - Davisville	124.6-168.0	43.4	0	2
Davisville - Atwells	168.0-184.2	16.2	2	18[1]
Atwells - Lawn	184.2-188.8	4.6	1	1
Lawn - South Attleboro	188.8-192.2	3.4	0	0
South Attleboro - Attleboro	192.2-197.2	5.0	2	2
Attleboro - Mansfield	197.2-204.2	7.0	4	7
Mansfield - Canton Junction	204.2-213.8	9.6	2	2
Canton Junction - Route 128	213.8-217.2	3.4	4	4
Route 128 - Readville	217.2-220.0	2.8	6	6
Readville - Back Bay	220.0-228.0	8.0	0	0
Back Bay - Boston Herald	228.0-228.3	0.3	4	4
Boston Herald - South Bay Wye	228.3-228.5	0.2	2	2
South Bay Wye - South Station	228.5-229.4	0.9	0	0

Note: [1]Assumes RIDOT and P&W undertake clearance programs from Worcester to Davisville, and successful development of Quonset Point as a major industrial and port facility.

Sources: Providence & Worcester Railroad Company and Conrail

TABLE 3.9-4 Existing Level of Service[1] at Critical Intersections

STATION[2]	INTERSECTION	APPROACH	EXISTING LOS	
			AM	PM
South	Summer Street/ Atlantic Avenue	Overall	F	F
Route 128	Blue Hill Drive/ Route. 128	LT 128 ramp	D	B
	Blue Hill Drive/ University Avenue	LT Univ.	A	D
		Blue Hill (all)	F	F
Providence	Smith/Gaspee/State Streets	Overall	F	F
	Francis/Gaspee Streets	Overall	A	B

Notes: [1]See Section 3.9-2 for Level of Service definitions.
[2]New Haven not available.

Source: DMJM/Harris, 1993

TABLE 3.9-5 Existing Amtrak-Generated Parking Demand at Railroad Stations[1]

STATION	SUPPLY	DEMAND
South Station	0	110
Back Bay	0	15
Route 128	820[2]	170
Providence	360[3]	200
New Haven	1,207[4]	240

Sources: [1]Demand: Estimates by DMJM/Harris
[2]MBTA
[3]RIDOT
[4]ConnDOT-125 spaces reserved for Police Department

TABLE 3.9-6 Location and Characteristics of Proposed Bridge Modifications

BRIDGE	MILE POST	MUNICIPALITY	1993 AVERAGE DAILY TRAFFIC	ACTION	DETOUR	DURATION (in months)
Johnnycake Hill Road[1]	108.51	Old Lyme, CT	N/A	Demolition	No[1]	1
Millstone Road (West)	117.31	Waterford, CT	--[2]	Raise	Yes	2.5
Burdickville Road	148.41	Charlestown, RI	150	Replace	No	4
Kenyon School Road	154.04	Richmond, RI	349	Replace	Yes	3
Pettaconsett Avenue	178.46	Warwick, RI	1,360	Replace	Yes	4.5
Park Avenue	180.29	Cranston, RI	17,470	Raise	Yes	4
Maskwonicut Street	211.62	Sharon, MA	1,770	Raise	Yes	3

Notes: [1]Footbridge
[2]As this bridge only serves one residence, traffic counts were not performed.

Source: Amtrak, 1993

TABLE 3.9-7 Roadway Characteristics and Average Existing Delay of Vehicles per Train Event at Grade Crossings with Automatic Gates

GRADE CROSSING	SPEED (mph)	# TRAINS/DAY	DELAY/TRAIN EVENT[3] (seconds)	DELAY/ VEHICLE[1] (seconds)	SURROUNDING LAND USE	SURROUNDING CHARACTER
Miners Lane[2]	60	22	26.46	13.23	Industrial	Rural
Bank Street[2]	25	22	35.51	17.75	Commercial	Urban
State Street[2]	25	22	35.51	17.75	Commercial	Urban
Gov. Winthrop Blvd.[2]	25	22	35.51	17.75	Commercial	Urban
School Street[2]	70	22	25.54	12.77	Residential	Suburban
Broadway Ext.	50	20	27.76	13.88	Commercial	Suburban
Latimer Point Rd.	70	20	25.54	12.77	Residential	Rural
Wamphassuc	60	20	25.54	12.77	Residential	Rural
Walkers Dock Rd.	70	20	25.54	12.77	Residential	Suburban
Freeman's Crossing	70	20	25.54	12.77	Residential	Suburban
Palmer Street	80	20	24.85	12.42	Residential	Urban
Wolf Rocks Rd.	100	20	23.88	11.94	Residential	Rural

Notes: [1] Computed based on 0.5 x time grade crossing gates in down position.
[2] Includes Montrealer Service.
[3] Includes total warning and gate down time.

Source: Amtrak, 1993

TABLE 3.9-8 Moveable Bridge Summary

MOVEABLE BRIDGE/ MUNICIPALITY/ MILEPOST	BRIDGE TYPE	CLEARANCE IN CLOSED POSITION		YEAR BUILT	NOTES
		Vertical (ft)	Horizontal (ft)		
Connecticut River| Old Saybrook/ Old Lyme, CT/ MP 106.89	Bascule	19	139	1917	Bridge rehabilitated from 1980/82
Niantic River| East Lyme/ Waterford, CT/ MP 116.74	Bascule	11	45	1906	Scheduled to be replaced as part of NECIP
Shaw's Cove| New London, CT/ MP 122.6	Swing	6	(2) 35-foot-wide channels	1984	Recent construction as part of NECIP.
Thames River| New London/ Groton, CT/ MP 124.09	Bascule	30	151	1919	Bridge rehabilitated from 1980/82. Scheduled to be replaced as part of NECIP.
Mystic River| Groton/ Stonington, CT/ MP 132.2	Swing	4	(2) 65-foot-wide channels	1984	Recent construction as part of NECIP.

Source: Nautical Chart 12372. *Watch Hill to New Haven Harbour*. Edition 27. National Oceanic and Atmospheric Administration, March 1, 1993.

TABLE 3.9-9 Railroad Movements, Typical Weekday, 1993

Bridge	Railroad Movements across Bridge			
	Amtrak (intercity)	Shore Line East (commuter)	P&W RR (freight)	Total
Connecticut River	22	0	2	24
Niantic River	22	0	2	24
Shaw's Cove	22	0	2	24
Thames River	20	0	2	22
Mystic River	20	0	0	20

Sources: Amtrak, Northeast Timetable effective May 1, 1994
ConnDOT, Commuter Timetable as of May 1, 1994
P&W letters dated December 14, 1992 and February 18, 1994

TABLE 3.9-10 Moveable Bridge Operations[1], 1993

BRIDGE	MONTH											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Connecticut River	59	54	62	109	299	412	575	551	433	328	145	60
Niantic River	30	22	57	122	319	415	515	526	328	455	171	66
Shaw's Cove	40	35	40	79	245	310	410	350	218	201	109	79
Thames River	87	113	104	130	192	222	363	293	199	213	103	110
Mystic River	24	30	37	106	312	440	567	529	439	341	130	58

Notes: [1]One operation includes one raise/lower cycle

Source: Amtrak, 1994

TABLE 3.10-1 Federal and State Ambient Air Quality Standards[1]

POLLUTANT	AVERAGE TIME PERIOD	UNITS	FEDERAL	CT	RI	MA
Carbon Monoxide	8-hour	ppm[1]	9[2]	9	9	9
	1-hour	ppm	35	35	35	35
Ozone	1-hour	ppm	0.12	0.12	0.12	0.12
NO_2	Annual	$\mu g/m^3$[3,2]	100	100	100	100
Lead	3-month	$\mu g/m^3$	1.5	1.5	1.5	1.5
SO^2	Annual	$\mu g/m^3$	80	80	80	80
	24-hour	$\mu g/m^3$	365	365	365	365
	3-hour	$\mu g/m^3$	1300[3]	1300	1300	1300
PM10	Annual	$\mu g/m^3$	50	50	50	50
	24-hour	$\mu g/m^3$	150	150	150	150

Notes: [1]Federal and state standards, except for annual means, are not to be exceeded more than once per year.
[2]Concentrations are given in parts per million (ppm) or in micrograms per cubic meter ($\mu g/m^3$).
[3]The tabulated thresholds are for primary standards which are for protection of public health. Secondary standards are for protection of public welfare. All secondary standards are the same as the primary standards, except for the 3-hour SO_2 which is secondary standard only.

Source: KM Chang Environmental, Inc., 1993

TABLE 3.10-2 1991 Monitoring Results for the Project Corridor[1]

SITE ID	MUNICIPALITY	MAX. 1-HR.		MAX. 8-HR.		MAX. 24-HR.		ANNUAL	NO. OBS. > STD.[2]
		1ST	2ND	1ST	2ND	1ST	2ND		
Carbon Monoxide[3]									
09-009-0019	New Haven, CT[4]	10.8	9.7	6.5	6.3	--	--	--	0
44-007-0015	Providence, RI[5]	14.7	11.2	7.1	6.8	--	--	--	0
44-007-0015	Providence, RI	11.8	11.3	8.2	7.4	--	--	--	0
25-025-0002	Boston, MA[6]	7.4	6.5	4.9	4.2	--	--	--	0
25-025-0016	Boston, MA[6]	7.9	7.2	5.3	4.2	--	--	--	0
25-025-0021	Boston, MA[6]	7.9	6.5	3.7	3.6	--	--	--	0
25-025-0038	Boston, MA[6]	8.0	6.7	4.3	4.2	--	--	--	0
Ozone[7]									
09-0009-1123	New Haven, CT	0.161[4]	0.147	--	--	--	--	--	7
44-007-0012	Providence, RI	0.116[5]	0.114	--	--	--	--	--	0
25-025-1003	Chelsea, MA	0.126[6]	0.122	--	--	--	--	--	1
Nitrogen Dioxide[8]									
09-009-0021	New Haven, CT	--	--	--	--	--	--	0.028	0
44-007-0012	Providence, RI	--	--	--	--	--	--	0.025	0
25-025-0002	Boston, MA	0.154[6]	0.150	--	--	--	--	0.035	0
25-025-0021	Boston, MA	0.092	0.089	--	--	--	--	0.032	0

Notes: [1]All concentrations are in parts per million (ppm)
[2]The number of observations exceeding the standard shown in Table 3.10-1.
[3]The carbon monoxide 1-hour standard is 35 ppm and the 8-hour standard is 9 ppm.
[4]Source: 1991 Air Quality Data Summary - CT Department of Environmental Protection.
[5]Source: 1991 Air Quality Data Summary - RI Department of Environmental Management.
[6]Source: 1991 Air Quality Data Summary - MA Department of Environmental Protection.
[7]The ozone 1-hour standard is 0.125 ppm.
[8]The nitrogen dioxide annual standard is 0.05 ppm and the Massachusetts 1-hour NO_2 Policy level is 0.170 ppm.
[9]PM10 means particulate matter of 10 microns in diameter or smaller. The PM10 24-hour standard is 150 $\mu g/m^3$ and the Annual standard is 50 $\mu g/m^3$.

Source: Various state publications and data sources (see Notes above), 1993

TABLE 3.10-3 Sources of Existing Emissions (tons/day)

POLLUTANT	COUNTY	POINT SOURCES	AREA SOURCES	MOBILE SOURCES	BIOGENIC SOURCES	TOTAL EMISSIONS
Carbon Monoxide	New Haven County, CT	3.6	3.4	378.7	--	386
	Washington, Providence, and Kent Counties, RI	6.2	1.7	587.6	--	596
	Norfolk and Suffolk Counties, MA	6.0	16.2	555.1	--	577
Oxides of Nitrogen	New Haven County, CT	23.3	2.5	75.0	--	101
	Washington, Providence, and Kent Counties, RI	13.9	3.3	70.1	--	87
	Norfolk and Suffolk Counties, MA	53.4	28.6	101.1	--	183
Volatile Organic Compounds	New Haven County, CT	15.5	52.7	49.6	48.7	168
	Washington, Providence, and Kent Counties, RI	24.7	52.3	76.3	65.9	219
	Norfolk and Suffolk Counties, MA	18.2	92.6	78.7	25.9	216

Sources: CT DEP, RI DEM, MA DEP, 1993

TABLE 3.10-4 Existing Project-Related VOC Emissions in the NEC by State (kg/day)

SOURCE	CONNECTICUT		RHODE ISLAND		MASSACHUSETTS		CORRIDOR TOTAL	
	KG/DAY	%	KG/DAY	%	KG/DAY	%	KG/DAY	%
Automobiles	3,464	97.2	1,029	80.3	1,102	69.5	5,595	87.0
Aircraft	42	1.8	230	17.9	407	25.7	679	10.6
Amtrak	28	1.2	18	1.4	14	0.9	60	0.9
Other Trains	16	0.4	2	0.2	48	3.0	66	1.0
Buses	15	0.4	3	0.2	14	0.9	32	0.5
Power Generation	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	3,565	100	1,282	100	1,585	100	6,432	100

Sources: CT DEP, RI DEM, MA DEP, 1993

TABLE 3.10-5 Existing Project-Related NO_X Emissions in the NEC by State (kg/day)

SOURCE	CONNECTICUT		RHODE ISLAND		MASSACHUSETTS		CORRIDOR TOTAL	
	KG/DAY	%	KG/DAY	%	KG/DAY	%	KG/DAY	%
Automobiles	4,680	73.5	1,444	64.5	1,488	33.4	7,612	58.3
Aircraft	34	0.5	87	3.9	700	15.7	821	6.3
Amtrak	909	14.3	576	25.7	469	10.5	1,954	15.0
Other Trains	505	7.9	80	3.6	1,568	35.2	2,153	16.5
Buses	236	3.8	52	2.3	229	5.2	517	3.9
Power Generation	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	6,364	100	2,239	100	4,454	100	13,057	100

Source: CT DEP, RI DEM, MA DEP, 1993

TABLE 3.10-6 Existing Project-Related CO Emissions in the NEC by State (kg/day)

SOURCE	CONNECTICUT		RHODE ISLAND		MASSACHUSETTS		CORRIDOR TOTAL	
	KG/DAY	%	KG/DAY	%	KG/DAY	%	KG/DAY	%
Automobiles	23,836	98.9	7,470	94.0	7,580	82.9	38,886	94.3
Aircraft	102	0.4	403	5.1	1,315	14.5	1,820	4.4
Amtrak	80	0.3	51	0.7	41	0.4	172	0.4
Other Trains	45	0.2	7	0.1	138	1.5	190	0.5
Buses	69	0.2	15	0.1	67	0.7	151	0.4
Power Generation	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	24,132	100	7,946	100	9,141	100	41,219	100

Source: CT DEP, RI DEM, MA DEP, 1993

TABLE 3.10-7 Existing Project-Related SO_2 Emissions in the NEC by State (kg/day)

SOURCE	CONNECTICUT		RHODE ISLAND		MASSACHUSETTS		CORRIDOR TOTAL	
	KG/DAY	%	KG/DAY	%	KG/DAY	%	KG/DAY	%
Automobiles	178	46.1	52	34.4	57	14.6	287	30.9
Aircraft	2	0.5	6	3.9	43	11.0	51	5.5
Amtrak[1]	125	32.3	79	52.3	64	16.4	268	28.9
Other Trains[1]	69	17.9	11	7.4	216	55.2	296	31.9
Buses	12	3.2	3	2.0	11	2.8	26	2.8
Power Generation[2]	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	386	100	151	100	391	100	928	100

Notes: [1]SO_2 emissions based on 0.5 percent sulphur in the diesel fuel.
[2]SO_2 emissions based on 1.0 percent sulphur in Number 6 fuel oil.

Source: CT DEP, RI DEM, MA DEP, 1994

TABLE 3.10-8 Estimated Maximum 1992 Baseline 8- and 1-Hour CO Concentrations[1] at the Intersection of University Avenue and Blue Hill Drive

RECEPTOR LOCATION	8-HOUR	1-HOUR
R1 Westwood Office Park	5.7	9.6
R2 Rt. 128 Train Station	4.0	6.7
R3 General Motors Bldg.	4.3	7.2
R4 Blue Hill Rd. EB @ 10m	9.4[2]	15.9
R5 Blue Hill Rd. EB @ 20m	9.4[2]	15.9
R6 Blue Hill Rd. EB @ 40m	9.4[2]	15.9
R7 University Ave. SB @ 10m	6.1	10.3
R8 University Ave. SB @ 20m	6.7	11.3
R9 University Ave. SB @ 40m	6.0	10.1
R10 University Ave. NB @ 10m	9.3[2]	15.7
R11 University Ave. NB @ 20m	8.7	14.7
R12 University Ave. NB @ 40m	7.9	13.3
R13 Green Lodge Rd. WB @ 10m	N/A[3]	N/A
R14 Green Lodge Rd. WB @ 20m	N/A	N/A
R15 Green Lodge Rd. WB @ 40m	N/A	N/A

Notes: [1]Concentrations are in parts per million (ppm). The Federal and Massachusetts 8- and 1-hour standards are respectively 9 and 35 ppm.
[2]These entries represent violations of the standards.
[3]NA means not applicable.

Source: KM Chng Environmental, Inc., 1993

TABLE 3.10-9 Estimated Maximum 1992 Baseline 8- and 1-Hour CO Concentrations[1] at the Intersections of Blue Hill Drive and Route 128 South Ramps

RECEPTOR LOCATION	8-HOUR	1-HOUR
R1 Residence A	4.7	7.8
R2 Residence B	3.7	6.2
R3 Residence C	3.3	5.5
R4 Westwood Office Park	3.8	6.4
R5 Blue Hill Rd. EB @ 10m	7.0	11.8
R6 Blue Hill Rd. EB @ 20m	7.3	12.3
R7 Blue Hill Rd. EB @ 40m	6.2	10.4
R8 Rt. 128 SB Off-Ramp @ 10m	4.7	7.9
R9 Rt. 128 SB Off-Ramp @ 20m	4.2	7.0
R10 Rt. 128 SB Off-Ramp @ 40m	3.8	6.4
R11 Blue Hill Rd. WB @ 10m	5.2	8.7
R12 Blue Hill Rd. WB @ 20m	5.1	8.6
R13 Blue Hill Rd. WB @ 40m	4.7	7.9

Notes: [1]Concentrations are in parts per million (ppm). The Federal and Massachusetts 8- and 1-hour standards are respectively 9 and 35 ppm.

Source: KM Chng Environmental, Inc., 1993

TABLE 3.11-1 Visual Modification Determinations For Visually Sensitive Receptors

LOCATION OF VISUALLY SENSITIVE RECEPTOR	VISUALLY SENSITIVE RECEPTOR	APPROX. DISTANCE (IN FT.) FROM VSR	VIEW FROM VSR	VISUAL COMPLEXITY	VMC[1]
33 Thimble Island Rd. Branford, CT	Residence	240	Long Island Sound	High	2
45 Thimble Island Rd. Branford, CT	Residence	320	Long Island Sound	Moderate	4
49 Thimble Island Rd. Branford, CT	Residence	500	Long Island Sound	High	3
53 Thimble Island Rd. Branford, CT	Residence	470	Long Island Sound	Moderate	3
59 Thimble Island Rd. Branford, CT	Residence	160	Long Island Sound	Moderate	4
63 & 71 Thimble Island Rd. Branford, CT	Residence	160	Long Island Sound	Moderate	4
76 Thimble Island Rd. Branford, CT	Residence	350	Long Island Sound	High	3
78 Thimble Island Rd. Branford, CT	Residence	350	Long Island Sound	High	3
82 Thimble Island Rd. Branford, CT	Rectory	340	Long Island Sound	High	2
W. of 229 Leetes Island Rd. Guilford, CT	From Road	320	Cockaponset Forest	Moderate	4
229 Leetes Island Rd. Guilford, CT	Residence	200	Long Island Sound	High	2
429 Stone House Lane Guilford, CT	Residence	140	Long Island Sound	High	2
40 Nod Place Guilford, CT	Residence	30	Long Island Sound/East R.	High	2
21 Clark St. Old Saybrook, CT	Residence	170	Connecticut River & Long Island Sound	High	2
69 McCurdy Road Old Lyme, CT	Golf Course	1000	Woodlands	High	2
147 Main Street Niantic, CT	Restaurant	50	Long Island Sound	Moderate	3
167 Main Street Niantic, CT	Restaurant	100	Long Island Sound	Moderate	3
45 Old Black Point Rd. East Lyme, CT	Residence	60	Wooded area, Pettagansett River	High	3
43 Old Black Point Rd. East Lyme, CT	Residence	50	Wooded area, Pettagansett River	High	3
265 Lake Shore Rd. Waterford, CT	Residence	730	Wooded area, Jordan Cove	High	2
268 Lake Shore Rd. Waterford, CT	Residence	730	Wooded area, Jordan Cove	Moderate	2
71 Lamphere Rd. Waterford, CT	Residence	360	Wooded area, Jordan Cove	Moderate	3
36 Bank Street New London, CT	Restaurant/Bar	75	New London Harbor	Low	4
2 State Street New London, CT	Restaurant	50	New London Harbor	High	2
New London Station New London, CT	Train Station	20	Commercial/Indust.	Moderate	3

Table 3.11 - 1. Visual Modification Determinations For Visually Sensitive Receptors (continued)

LOCATION OF VISUALLY SENSITIVE RECEPTOR	VISUALLY SENSITIVE RECEPTOR	APPROX. DISTANCE (IN FT.) FROM VSR	VIEW FROM VSR	VISUAL COMPLEXITY	VMC[1]
Bluff Point State Park Groton, CT	Park	1000	Inland	High	1
211 Seneca Drive Groton, CT	Residence	140	Residential uses, Palmer Cove	Moderate	4
235 Seneca Drive Groton, CT	Residence	160	Palmer Cove, L.I. Sound, Esker Point Beach	Moderate	4
Groton Long Point Rd. Groton, CT	View From Road	920	Palmer Cove	Low	2
239 Elm St. Groton, CT	Residence	1500	Beebe Cove	High	1
63 Cedar Rd. Groton, CT	Residence	1100	Mystic River	Moderate	3
21 Buttonwood Lane Groton, CT	Residence	480	Mystic Harbor	High	2
112 Elm Street Noank, CT	Residence	1500	Fisher Island Sound	High	2
Junc. Routes 1 & 27 Mystic, CT	Restaurant	1500	Mystic Harbor	Low- Moderate	3
8 Maple Street Mystic, CT	Residence	70	wetlands	High	2
50 West Mystic Ave. Mystic, CT	Residence	275	Mystic River	Moderate	3
20 & 23 Wilcox Rd. Stonington, CT	Residence	170	Long Island Sound, vegetation	Low	4
34 Wilcox Rd. Stonington, CT	Residence	130	Long Island Sound	Moderate	4
36 Wilcox Rd. Stonington, CT	Residence	170	Long Island Sound	Low	4
44 Wilcox Rd. Stonington, CT	Residence	250	Long Island Sound	Low	4
68 Wilcox Rd. Stonington, CT	Residence	500	Long Island Sound	Low	2
162 Wilcox Rd. Stonington, CT	Residence	480	Long Island Sound	Low	2
Harbor View Ter. Stonington, CT	From Road	1280	Stonington Harbor	Moderate	1
3 Lambert's Lane Stonington, CT	Residence	880	Stonington Harbor	Moderate	1
13 Lambert's Lane Stonington, CT	Residence	880	Stonington Harbor	Moderate	1
End of Summit St. Stonington, CT	From Road	140	Long Island Sound	Low	4
13 Bayview St. Stonington, CT	Residence	80	Long Island Sound	Low	4
Elihu St. Stonington, CT	Residence	50	Long Island Sound	Low	4
15 Bradley St. Stonington, CT	Residence	40	Long Island Sound	Moderate	4
2 Cheesbro Lane Stonington, CT	Residence	150	Little Narragansett Bay, Sandy Point	Moderate-High	3
8 Cheesbro Lane Stonington, CT	Residence	320	Little Narragansett Bay, Sandy Point	Moderate-High	4
End of Island Rd. Stonington, CT	Residence	450	Wequetequock Cove	Low	2

Table 3.11 - 1. Visual Modification Determinations For Visually Sensitive Receptors (continued)

LOCATION OF VISUALLY SENSITIVE RECEPTOR	VISUALLY SENSITIVE RECEPTOR	APPROX. DISTANCE (IN FT.) FROM VSR	VIEW FROM VSR	VISUAL COMPLEXITY	VMC[1]
142 Mill Pond Rd. Exeter, RI	Residence	500	Yawgoo Mill Pond, turf farm	High	2
9 Ladd Rd. Warwick, RI	Residence	50	Greenwich Bay	Low-Moderate	4
7 Ladd Rd. Warwick, RI	Residence	50	Greenwich Bay	Moderate	3
20 Blackstone St. Warwick, RI	Residence	125	Greenwich Bay	Moderate-High	3
10 Williams St. Warwick, RI	Residence	125	Greenwich Bay	Moderate	2
5 Williams St Warwick, RI	Residence	125	Greenwich Bay	Low	3
4496 Boston Post Rd. Warwick, RI	Condos	75	Greenwich Bay	Low	4
4490 Boston Post Rd. Warwick, RI	Condos	50	Greenwich Bay	Low	4
4480 Boston Post Rd. Warwick, RI	Condos	50	Greenwich Bay	Low	4
4456 Boston Post Rd. Warwick, RI	Residence	125	Greenwich Bay	Moderate	3
4158 Boston Post Rd. Warwick, RI	Condos	125	Greenwich Bay	Low	4
4090 Boston Post Rd. Warwick, RI	Condos	125	Greenwich Bay	Low	4
3986 Boston Post Rd. Warwick, RI	Nursing Home	500	Greenwich Bay	Moderate-High	3

[1]Visual Modification Classification (VMC) of 3 or 4 indicates an adverse impact.

Source: DMJM/Harris, 1994

TABLE 3.12-1 Occurrence of Natural Resources on Substation Sites and Power Line Corridors[1]

SUBSTATION & UTILITY CORRIDOR	MILEPOST	WETLANDS	WILDLIFE VALUE	ENDANGERED SPECIES	FLOOD PLAINS	COASTAL RESOURCES	WATER RESOURCES	SPECIAL PROTECTED AREAS
Branford Branford, CT	79.26	near access road	limited	none	none	none	private wells	none
New London New London, CT	123.55	none	very limited	none	substation	substation: developed shorefront	none	none
Warwick Warwick, RI	176.91	none	limited	none	none	none	none	none
Roxbury Crossing Boston, MA	226.02	none	minimal	none	none	none	none	none

Notes: [1]***Wetlands:*** indicates whether the site is in wetlands or the buffer zone. Buffer zone in Connecticut municipalities is 50 feet unless otherwise specified in text. Buffer zone in Rhode Island is 50 feet unless otherwise specified in text. Buffer zone in Massachusetts is 100 feet.

Wildlife: indicates the value of the site as wildlife habitat and considers the presence and appropriateness of the plant community for providing food and cover and the diversity of the habitat (e.g., open fields, wetlands, forest).

Endangered Species: indicates the presence of threatened or endangered species, as defined in the Endangered Species Act, using information provided by the states' Natural Heritage Inventories.

Floodplains: indicate whether a site falls within the boundaries of the 100-year flood zone.

Coastal Resources: indicates whether the site falls within the coastal zone, as delineated by each states' coastal zone management agency. Connecticut, coastal resources are categorized and the category shoreland describes uplands.

Water Resources: indicates whether the site is on or near ground or surface drinking water supplies, other surface waters, or water resource protection areas.

Special Protected Areas: indicates whether the site falls within the boundaries of areas designated to be unique clusters with natural and human resource values worthy of a high level of concern and protection.

Source: Smart Associates, Inc., 1993

TABLE 3.12-2 Occurrence of Natural Resources on Switching Station Sites[1]

SWITCHING STATION & MUNICIPALITY	MILEPOST	WETLANDS	WILDLIFE VALUE	ENDANGERED SPECIES	FLOOD PLAINS	COASTAL RESOURCES	WATER RESOURCES	SPECIAL PROTECTED AREAS
Westbrook Old Saybrook, CT	103.74	none	limited	none	none	none	none	none
Richmond Richmond, RI	150.15	none	limited	none	none	none	sole source aquifer (EPA)	none
Norton Attleboro, MA	198.99	buffer	diverse edge habitat	none	none	none	Bungay River Water Resource Protection District	none

Notes: [1]See notes following Table 3.12-1 for descriptions of resource categories.

Source: Smart Associates, Inc., 1993

TABLE 3.12-3 Occurrence of Natural Resources on Paralleling Station Sites[1]

PARALLELING STATION & MUNICIPALITY	MILEPOST	WETLANDS	WILDLIFE VALUE	ENDANGERED SPECIES	FLOOD PLAINS	COASTAL RESOURCES	WATER RESOURCES	SPECIAL PROTECTED AREAS
Leetes Island Guilford, CT	85.99	yes	limited	none	yes	coastal flood hazard area	none	none
Madison Madison, CT	92.41	buffer	limited	none	none	none	none	none
Grove Beach Westbrook, CT	99.11	buffer	limited	none	none	shorelands	none	none
Old Lyme Old Lyme, CT	109.50	none[2]	moderate	none	none	shorelands	none	none
Millstone Waterford, CT	117.54	none	moderate: many species	none	none	shorelands	buffer	none
Noank Groton, CT	129.52	buffer	limited	none	none	coastal flood hazard area	none	none
Stonington Stonington, CT	134.65	none	moderate	state endangered species possible	yes	shorelands	none	none
State Line Stonington, CT	139.93	none[2]	limited	none	none	shorelands	sole source aquifer (EPA)	none
Bradford Westerly, RI	145.19	buffer	limited	none	none	none	critical recharge area and sole source aquifer (EPA), public wells	none
Kingston S. Kingstown, RI	157.11	none	high	none	none	none	sole source aquifer (EPA)	yes
Exeter Exeter, RI	161.78	none	moderate	none	none	none	sole source aquifer (EPA), community well	none

TABLE 3.12-3 Occurrence of Natural Resources on Paralleling Station Sites (continued)

PARALLELING STATION & MUNICIPALITY	MILEPOST	WETLANDS	WILDLIFE VALUE	ENDANGERED SPECIES	FLOOD PLAINS	COASTAL RESOURCES	WATER RESOURCES	SPECIAL PROTECTED AREAS
East Greenwich N. Kingstown, RI	169.80	none	limited	none	none	none	designated wellhead protection area; local groundwater recharge area	none
Elmwood Pawtucket, RI	181.49	none	limited	none	none	none	none	none
Providence Providence, RI	187.45	none	limited	none	none	none	none	none
Attleboro Attleboro, MA	193.45	none	limited	none	none	none	Ten Mile River buffer	none
East Foxboro Foxboro, MA	205.70	none	moderate	none	none	none	within Canoe River ACEC, outside aquifer	yes
Canton Sharon, MA	212.38	buffer	limited	none	none	none	none	none
Readville Boston, MA	219.08	none	limited	none	none	none	300 ft inside Fowl Meadow ACEC	yes

Notes: [1]See notes following Table 3.12-1 for descriptions of resource categories.

[2]These sites are listed on town wetlands maps as poorly drained soils, which are considered wetlands by the towns and by Long Island Sound (coastal zone) Program. Field investigations, however, determined that these are filled areas with no wetlands characteristics. Amtrak should apply for reclassification of these sites. Documentation for the proposed redesignation is included in Volume II of this FEIS/R. Upon reclassification, they will be classified as shorelands - the coastal zone designation for uplands.

Source: Smart Associates, Inc., 1993

TABLE 3.12-4 Occurrence of Natural Resources at Bridges to be Modified

BRIDGE NAME & MUNICIPALITY	MILE POST	WETLANDS	WILDLIFE VALUE	ENDANGERED SPECIES	FLOOD PLAINS	COASTAL RESOURCES	WATER RESOURCES	SPECIAL PROTECTED AREAS
Johnnycake Hill Road Old Lyme, CT	106.51	none	edge habitat	none	none	none	none	none
Millstone Road (West) Waterford, CT	117.31	buffer	limited	none	none	shorelands	none	none
Burdickville Road Charlestown, RI	148.41	westerly approach road buffer	moderate	none	none	none	sole source aquifer (EPA)	none
Kenyon School/ Beaver River Road Richmond, RI	154.04	buffer, Pawcatuck River	limited	none	none	none	sole source aquifer (EPA)	none
Pettaconsett Avenue Warwick, RI	178.48	none	limited	none	none	none	none	none
Park Avenue Cranston, RI	180.29	none	limited	none	none	none	none	none
Maskwonicut Street Sharon, MA	211.62	wetlands & buffer	moderate	none	yes	none	groundwater protection district, Beaver Brook	none

Notes: [1]See notes following Table 3.12-1 for descriptions of resource categories.

Source: Smart Associates, Inc., 1993

TABLE 3.12-5 Occurrence of Natural Resources at Moveable Bridge Cable Crossings

MOVEABLE BRIDGE & MUNICIPALITY	WETLANDS	WILDLIFE VALUE	ENDANGERED SPECIES	FLOOD PLAINS	COASTAL RESOURCES	WATER RESOURCES	SPECIAL PROTECTED AREAS
Connecticut River Old Saybrook/Old Lyme, CT	in river	moderate	Federal - short nosed sturgeon	yes	coastal flood hazard area; estuarine embayment	Connecticut River	none
Niantic River East Lyme/ Waterford, CT	in river	moderate	none	yes	coastal flood hazard area; beaches & dunes	Niantic River	none
Shaw's Cove New London, CT	in river	moderate	none	yes	coastal flood hazard area; developed shorefront	Shaw's Cove	none
Thames River New London/ Groton, CT	in river	moderate	none	yes	coastal flood hazard area; estuarine embayment; developed shorefront	Thames River	none
Mystic River Groton/ Stonington, CT	in river	moderate	none	yes	coastal flood hazard area; estuarine embayment; developed shorefront	Mystic River	none

Source: Smart Associates, Inc., 1993

♦ Appendix C

Public Participation
MEPA Certificate

APPENDIX C
PUBLIC PARTICIPATION PROGRAM

The National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA) afford citizens the opportunity to review and comment upon a public agency's analysis of the environmental impacts of proposed major government actions. Under NEPA and MEPA the joint FEIS/R serves as the vehicle for obtaining public input into project decision-making. In addition to these regulations, FRA has encouraged the active participation of private citizens and Federal, state, and local agencies throughout the course of this study. This involvement is important to ensure that issues of concern to communities and agencies are addressed in the EIS/R, and that the resulting project is responsive to those concerns and in compliance with relevant Federal and state mandates.

MAJOR PUBLIC PARTICIPATION ACTIVITIES

The public involvement program for this project consists of five elements. These include:

- Scoping sessions -- NEPA and MEPA
- Public information meetings
- Public hearings
- Coordination and consultation with regulatory agencies
- Future outreach

Each of these elements is described below.

NEPA Scoping

Scoping for the proposed project began in September 1991. The study team met with regulatory agencies in Connecticut, Rhode Island, and Massachusetts, in addition to Federal agencies with jurisdiction under NEPA. These agencies included but are not limited to:

- Connecticut Department of Environmental Protection/ Office of the Long Island Sound Program
- Connecticut Department of Transportation: Highway, Rail Operations, and Environmental Coordination Departments
- Connecticut State Historic Preservation Officer
- Rhode Island Department of Transportation
- Rhode Island Department of Environmental Management
- Rhode Island State Historic Preservation Officer
- Massachusetts Executive Office of Transportation and Construction
- Massachusetts Executive Office of Environmental Affairs
- Massachusetts Bay Transportation Authority
- Massachusetts Highway Department
- Massachusetts State Historic Preservation Officer

The agencies have been briefed on Amtrak's electrification proposal and provided comments and suggestions regarding a work program for the environmental assessment.

In accordance with NEPA requirements, formal public scoping sessions were held in November 1991 at the following locations:

Location	Date	No. of Meetings
New London, CT	November 4 and 20	3
Providence, RI	November 5	2
Cambridge, MA	November 6	2
New Haven, CT	November 20	1

A Notice of Intent (NOI) to prepare the EIS appeared in the Federal Register on October 21, 1991, and in six regional newspapers along the study corridor: the *Boston Globe*; the *Boston Herald*; the *New Haven Register*; the *Providence Journal*; *The Day* (New London); and the *Hartford Courant*. Participants were invited to comment on the scope of the issues to be addressed in the environmental analysis.

Forty-eight government agencies and officials, 40 organizations, and 59 individuals attended the scoping sessions. Among the major issues raised were:

- Potential health effects of electromagnetic fields
- Aesthetic impact of the catenary installation
- Increased noise as a result of higher speed and more frequent trains
- Increased risk of higher speed trains striking pedestrians and vehicles
- Restricted access to the waterfront due to additional fencing

At the end of the public comment period, 150 comments were received from organizations and individuals. In addition to comments regarding impact categories and evaluation methods, several alternatives to the project were suggested, and were reviewed for consideration in the DEIS. A scoping document was prepared and distributed. This document identified the issues and alternatives raised in the scoping process and contained a summary of meeting minutes, oral and written comments, and a list of participants. It provided a framework for the subsequent screening, selection, and evaluation of alternatives, including the work program for the environmental assessment and resulting technical reports.

MEPA Scoping

Scoping requirements for Rhode Island and Connecticut were fulfilled by the NEPA scoping sessions. Massachusetts required a separate state environmental review process and scoping session pursuant to MEPA. A project Environmental Notification Form (ENF) was published in the *Environmental Monitor* on August 7, 1992; and one state scoping session was held on August 21, 1992.

As a result of the scoping session, the Massachusetts Secretary of Environmental Affairs directed FRA to prepare a state Environmental Impact Report for the project and outlined a scope for the study (see 9/9/92 MEPA Certificate). To reconcile the Federal and state environmental review processes, it was agreed that the project would prepare a combined Draft EIS and EIR (DEIS/R) followed by a Final EIS and EIR (FEIS/R).

Public Information Meetings

In the fall of 1992, public information meetings were held at the following locations:

Location	Date
Old Saybrook, CT	November 17
Madison, CT	November 18
Stonington, CT	November 19
Charlestown, RI	November 30
Cranston, RI	December 1
Attleboro, MA	December 2
Dedham, MA	December 7
Jamaica Plain, MA	December 8

Notices of the meetings were printed in 38 local newspapers and sent to two local cable television stations as well as posted in public buildings along the NEC. The purpose of these meetings was to report on the EIS process and status, and to explain the various project elements proposed by Amtrak. The study team reviewed the potential impacts of extending electrification north of New Haven and the proposed methodology for evaluating each impact. Amtrak officials were present to answer questions about the project design. Participants were invited to provide comments and suggestions; approximately 280 people attended the eight meetings.

The majority of issues raised at these meetings were already addressed in the DEIS/R scope. Several issues were raised that were beyond the scope of the project as defined by FRA and, therefore, were not addressed in the study. Three new issues were incorporated into the subsequent analysis. These included:

- Public safety at commuter rail stations
- Impacts to existing and future freight operations
- Expanded electromagnetic field (EMF) testing

Follow-up meetings were held in April 1993 at the request of participants in Stonington, CT, and in the Jamaica Plain-Roslindale area of Boston to present additional information on noise, vibration, EMF, and the impact analyses.

FRA has maintained a project mailing list of approximately 1,100 individuals and organizations who wrote or contacted FRA or MEPA regarding the project, or attended one of the meetings or scoping sessions described above. The mailing list has been updated on a regular basis and was used for distribution of DEIS/R material and notices of project-related meetings and events.

Coordination and Consultation with Regulatory Agencies

The project team has engaged in extensive coordination with Federal, state, and local government agencies since the outset of the study. These efforts have focused on: (1) data collection and the identification of resources; (2) compliance with regulatory requirements; and (3) review of study methods and results. Agencies consulted include:

AGENCY	TOPIC
· U.S. Soil Conservation Service Regional Offices	Farmlands, Soil and Farmland Protection Policy Act Coordination
· U.S. Fish and Wildlife Service and State Agencies	Section 7 Consultation, threatened and endangered similar species
· U.S. Army Corps of Engineers (USACE)	Section 404 and Section 10 permits, wetlands
· U.S. Coast Guard	Navigation and bridge construction permits
· U.S. Environmental Protection Agency	Air quality analysis methods
· U.S. Federal Aviation Administration	Effect of proposed construction on navigable airspace
· State Departments of Transportation, Highway and Transit Agencies	Proposed project and DEIS/R workplan
· Massachusetts Environmental Policy Act Unit	DEIS/R scope, required permits, and reviews
· State Departments of Environmental Protection	DEIS/R scope, required permits, and reviews
· State Historic Preservation Officers	Historic and archaeological resources and study methods
· Town Planning Departments	Land use and sensitive receptors

Public Hearings

The DEIS/R for the Northeast Corridor Improvement Project was filed in September 1993 with the U.S. Environmental Protection Agency and the Massachusetts Executive Office of Environmental Affairs. The general public was offered the opportunity to review and comment on the DEIS/R during FRA and Massachusetts Environmental Policy Act public review processes from October 15 to December 3 for NEPA, and December 9 for MEPA. In response to requests from several commenters, the review period for both was extended to January 21, 1994.

Public hearings were held on November 16 in Boston (afternoon and evening meetings), on November 17 in Cranston (afternoon and evening meetings), and on November 18 in Old Saybrook (afternoon meeting) and New London (evening meeting). Written comments also were received from public officials of the affected states and towns, public agencies, organizations, businesses, and individuals. The issues raised at the public hearings were similar to the written comments received; therefore, the latter only are fully responded to in this FEIS/R. All written comments and oral transcripts are reproduced in Volume IV; newspaper articles, comments on other studies, or other attachments, are not reproduced in this document. All comments and testimony, including attachments submitted by commenters, are available for public review at the office of the U.S. Department of Transportation, Volpe National Transportation Systems Center, 55 Broadway, Kendall Square, Cambridge, Massachusetts 02142, Telephone (617) 494-2002.

This joint final environmental impact statement and final environmental impact report addresses the comments received on the DEIS/R as well as the limited number of design changes that have occurred since the DEIS/R was published. It also identifies those mitigation measures that FRA intends to incorporate in its record of decision (ROD) on this proposed project. These mitigation measures, which are contained in Chapter 5 of the FEIS/R, parallel the Section 61 finding required by Massachusetts state regulations at 301 CMR 11.00.

The Federal and Massachusetts environmental review processes differ in the review afforded to final environmental documents. With regard to the Federal process, the FEIS contains the FRA's draft ROD. FRA will issue a final ROD, which incorporates consideration of any comments received on the FEIS or draft ROD, no sooner than 30 days after the FEIS becomes available.

With regard to the Massachusetts process, the Secretary of the State Executive Office of Environmental Affairs' (EOEA) certificate on the DEIS/R has requested that notice of the availability of the FEIS/R be published in the *Environmental Monitor* for two review cycles, a total of 60 days. During that period, comments can be submitted to the EOEA which will aid the Secretary in evaluating the document under the Massachusetts Environmental Protection Act.

Future Outreach

The draft ROD states that FRA is deferring its decision on the location of the northernmost substation site proposed by Amtrak for the Roxbury Crossing neighborhood of Boston. The purpose of this deferral is to permit involvement of the potentially affected community, and appropriate city and state agencies in the evaluation of the alternative locations and designs for this specific facility. Within three weeks of the publication of this FEIS/R, FRA will schedule a consultation meeting in the vicinity of Amtrak's proposed Roxbury Crossing substation and possible alternative locations to establish an ongoing process of community involvement in the siting and design of this facility.

Of a more general nature, the mitigation required in Chapter 5 of this project require Amtrak to consult with appropriate state and local agencies and the interested public in the development of various aspects of detailed project plans. The areas in which this input is sought include the monitoring of long term noise and vibration affects of intercity rail operations, monitoring EMF fields resulting from the Proposed Action, the design of noise barriers, identification of additional areas requiring fencing and development of a moveable bridge operating plan.

The EOEA certificate on the DEIS/R recommends that the project proponent (Amtrak) prepare a written outreach program to better inform the public on project activities. FRA agrees that such a program is needed and will require Amtrak to prepare such a program within 30 days of the release of this FEIS/R and seek comments on it from appropriate State agencies, including the MEPA unit of EOEA in Massachusetts.

As part of the outreach requirement and the need for agency and public output into the final design of specific aspects of the Proposed Action, FRA has required Amtrak to establish a community liaison program to solicit input, to ensure that residents are kept informed of planned construction activities, and to serve as a point where complaints can be registered. Amtrak's community liaison can be reached at the following address:

NECIP Community Liaison
Amtrak
Saybrook Junction Marketplace
455 Boston Post Road
Old Saybrook, CT 06475
(203) 395-3004

FRA will take an active role in identifying local concerns with implementation of the Proposed Action and other aspects of NECIP to aid in its oversight of Amtrak's NECIP-related activities. FRA has established a NECIP program fields office to serve as FRA's local presence in monitoring the implementation of all NECIP-related activities, and to serve as an independent point for agencies or the public to contact with issues associated with the NECIP program. FRA's contact can be reached at the following address:

Director
NECIP Program Office
Federal Railroad Administration
Glastonbury Corporate Center
Building 2, Suite 303
628 Hebron Avenue
Galstonbury, CT 06033

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

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January 28, 1994

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CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Northeast Corridor Improvement Project Electrification
PROJECT LOCATION	: Statewide - South Attleboro (RI Border) to South Station in Boston
EOEA NUMBER	: 9134
PROJECT PROPONENT	: National Railroad Passenger Corporation (AMTRAK)
DATE NOTICED IN MONITOR	: October 22, 1993

The Secretary of Environmental Affairs herein issues a qualified statement that the Draft Environmental Impact Report (EIR) submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L., c. 30, s. 61-62H) and with its implementing regulations (301 CMR 11.00).

The proposed project consists of the electrification of the Northeast Corridor (NEC) railroad main line between New Haven, CT and South Station in Boston using an overhead 25,000 volt - 60 hertz single phase catenary system. It involves the construction of an overhead catenary system composed of wires suspended over the railroad tracks. Within Massachusetts, from the Rhode Island border in South Attleboro to South Station, the NEC is approximately 38.5 miles long. It contains three passenger stations: South Station, Back Bay Station, and Route 128 Station.

The project includes four substations, 18 paralleling stations and three switching stations. A substation converts or "steps down" 115,000 volts from a utility's power line to a 25,000 volt level via a transformer. This power is then transferred to the overhead catenary system for use by the locomotive. Switching stations and paralleling stations are intermediate power supply points for the overhead catenary system

and contain transformers that connect the feeder lines to the catenary system. By employing these smaller facilities, fewer substations and utility tie-ins are needed and power can be carried farther down the rail line. These facilities are small in size and encompass less than .25 acres, whereas a substation is about a .5 acre in size. Within Massachusetts, the proponent proposes one substation at Roxbury Crossing in Boston, a switching station in Attleboro and four paralleling stations in Attleboro, East Foxboro, Canton, and Boston (Readville).

Catenary supports will be slender poles about 28 feet tall placed on both sides of the tracks within the ROW and spaced at approximately 200 foot intervals. In the Southwest Corridor of Boston, catenary supports will be supported from the bridges crossing the tracks. In some areas, the tracks will be lowered under overhead structures or structural modifications to overhead bridges will be undertaken to provide adequate clearance for the catenary. The Maskwonicut Street Bridge in Sharon would be the only bridge replacement (raising) as part of this project in Massachusetts. Fencing will be installed in some locations as part of this project.

The project traverses the Fowl Meadow and Ponkapoag Bog Area of Critical Environmental Concern (ACEC) and the Canoe River ACEC.

The project also requires an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA). In order to reduce duplication of effort, the MEPA Scope was incorporated into the federal scope, and the proponent has prepared a joint DEIS/EIR. My decision to certify the draft report as adequate will allow the federal and state level reviews to proceed on the same track, so to speak, and takes into account that federal requirements for the draft document are far less demanding than MEPA. However, I have advised the proponent that the DEIR was minimally adequate and that distribution and outreach to the affected community was seriously flawed. The DEIR did not respond adequately to the scope contained in the ENF Certificate in that it failed to fully address certain issues and did not commit to sufficiently specific mitigation measures. Accordingly, I hereby advise the proponent in advance that, if the FEIR has any of the above noted problems and does not follow the scope set forth below, I will find it inadequate and require a Supplemental FEIR.

SCOPE

General:

The FEIR should include individual site plans for each of the proposed facilities: substations, switching stations, and

paralleling stations. Better and more detailed mapping (at a larger scale) of the entire corridor within Massachusetts is necessary for the MEPA Unit to be able to judge the project's impacts. The proponent should consult with the MEPA Unit to determine an appropriate scale. The FEIR should follow the MEPA Regulations of 301 CMR 11.07, as modified by this scope, for outline and content. It must also address all comments submitted at the public meetings and/or in writing to the extent that they are within the scope of this review, and should include a copy of this Certificate.

The MEPA office has received a tremendous number of comments, the majority of which express serious concern about impacts, both from current operations and from the proposed changes. It should be understood that this impact review is required because of the proposed electrification and will be focused on potential impacts from that project. Nevertheless, existing conditions do need to be taken into account, since MEPA clearly requires an assessment of cumulative impacts. Existing conditions must also be considered when determining how additional impacts can be avoided, what options are available to minimize impacts, or what the appropriate mitigation measures are and how they should be implemented.

Alternatives Analysis:

The information provided on the siting of a substation at Roxbury Crossing is entirely inadequate to justify the selection of this site as the preferred alternative. The FEIR must identify and discuss alternative substation site locations that might result in fewer environmental impacts, in particular impacts to residential areas. It should analyze the impacts associated with each alternative site, including impacts on current, planned or possible land uses, and then provide a comparative analysis clearly showing the differences between the environmental impacts associated with the various alternatives.

If the Roxbury Crossing site is carried forward, a detailed analysis of land use and public health implications will be needed. I note that several commenters have criticized the proponent's argument that this site is preferable because of convenient access to a nearby 115,000 volt power source. The FEIR will need to move beyond conclusory statements and simplistic cost arguments. The analysis should disclose all available options to access a high voltage power source, including installation of one or more new feeds, and evaluate the feasibility, cost and likely environmental impacts associated

with each option. Cost-benefit comparisons should consider the costs of anticipated impacts and of mitigation, rather than just citing construction cost as the overriding factor. This also applies to comparing the costs and disadvantages of multiple facilities of a smaller size to those of one substation. Finally, the analysis should be sensitive to the community's experience, as described in some of the comments, with the siting of a facility that may have significantly more adverse impact than was initially asserted by proponents.

Traffic:

The FEIR should be prepared in conformance with the EOEA/EOTC Guidelines for EIR/EIS Traffic Impact Assessment. It should identify appropriate mitigation measures for areas where the project will impact traffic operations, such as at the Route 128 Station. The DEIR acknowledged the lack of sufficient parking at Route 128 Station. However, it proposed no mitigation measures or improvements at this location. I recommend that the proponent establish a task force to focus on the Route 128 Station in the context of this and other proposed projects. The task force should consist of representatives for the proponent, the MBTA, the Massachusetts Highway Department (MHD), the Executive Office of Transportation and Construction (EOTC), the Metropolitan District Commission (MDC), the Department of Environmental Management (DEM), the towns of Westwood and Dedham, and other concerned citizens.[1] It should be charged with specific tasks, to be completed within a defined time frame. I recommend the proponent provide technical assistance. The major objective of the task force should be to produce a sufficiently sized station and parking facility that will accommodate the needs of this project as well as the future needs of the MBTA. I note that this Route 128 Station and Parking Facility should be available at the same time that the electrification project becomes operational.

The FEIR should detail the impacts of the Maskwonicut Street Bridge closing on local traffic flow, identify any other impacts and propose mitigation to alleviate adverse impacts.

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[1] Alternatively or concurrently, the proponent may wish to consult with the Joint Regional Transportation Committee, members of which include state and regional agencies with an interest in this issue (which has already been on the Committee's agenda).

The FEIR should identify the estimated increased pedestrian activity at both South Station and Back Bay Station in Boston, and propose any necessary mitigation measures needed to accommodate this activity.

Freight:

The FEIR should identify the impacts of the project on Massachusetts rail freight shippers, as well as impacts on the operations of the Providence and Worcester Railroad Company (P&W), and address the concerns raised in comments relating to this issue. I reiterate that a mitigation package should be developed by the proponent. Railroad clearance requirements for freight service should be reviewed and coordinated with EOTC.

Air Quality:

I am concerned about air quality impacts at the Route 128 Station because of the increase in the number of vehicle trips the project will generate. Air quality microscale modeling for carbon monoxide will be needed for intersections deteriorating to a LOS D or worse where the project contributes 10 percent or more to the existing traffic volumes. DEP's Division of Air Quality Control should be consulted as to intersections, sensitive receptors, and model input parameters.

Noise and Vibration:

The DEIR anticipates an increase in noise and vibration along the corridor as a result of higher speeds and more frequent service. The report proposes noise mitigation such as construction of noise barriers and improving train wheel maintenance. It acknowledges the potential need to construct 22 miles of sound barriers along the entire project ROW. It also proposes the installation of as much as 12.5 miles of ballast mats under the existing railroad bed. However, information regarding the types and aesthetics of the barriers is not sufficiently detailed nor has the proponent committed to specific mitigation measures to address noise and vibration levels experienced in particular locations. In this context, the comments from many residents and community groups and representatives should be noted. The FEIR should provide a comprehensive analysis of impacts associated with existing and proposed conditions, identify impacted areas, consider all reasonably available means to avoid additional impacts, and commit to specific measures that are commensurate with the degree of unavoidable impact those areas are likely to experience.

Because the DEIR identified 787 residences, two churches, and two recreation areas which will be adversely impacted by the project, and because of the comment letters and verbal testimony at meetings regarding noise and vibration impacts from existing operations, I request that the proponent develop a noise and vibration monitoring program, by July 1, 1994, for the area within Boston known to be most affected by existing and proposed operations. The proponent should develop this noise and vibration monitoring program in consultation with DEP, MBTA, EOTC, EOEA, the City of Boston, as well as representatives from the community. Such a program will provide better data on existing conditions and establish the background for future projections, as well as a sound basis for a mitigation plan. It should, for example, help prioritize areas and structures based on impacts and guide the proponent's use of the remaining $400,000 allocated by the Federal Transit Administration (FTA) for noise mitigation along the Southwest Corridor.

I recommend that the FEIR provide for noise mitigation if a residential noise performance standard of 65 dBA LDN is exceeded in adjacent residential structures. Any applicable state and local noise standards must be addressed, as well. While trains are preempted from DEP's noise regulations at 310 CMR 7.10, the construction phase of the project as well as some of the proposed facilities are subject these regulations. DEP's policy #90-001 (dated February 1, 1990) also restricts both broad-band and pure tone sound. The FEIR should discuss mitigation measures the proponent will use during the construction and operation of the proposed facilities so as to meet applicable requirements. Because cumulative noise impacts are critical, the FEIR should not limit its noise analysis to incremental increases the proposed project will generate, nor can it limit itself to a "mean" averaging approach for a 24 hour period.

Electromagnetic Fields (EMF):

The FEIR should provide an update on reported EMF research. It should disclose and evaluate potential EMF impacts from any electrical facilities that are to be installed or relocated, as well as existing facilities and equipment. While there may not currently exist scientific consensus regarding whether or under what conditions EMF presents a health or environmental hazard, I suggest the proponent should err on the conservative side and acknowledge, as well as avoid and minimize to the greatest extent possible, potential impacts on human populations near the corridor and associated facilities. Previous community experience with the siting of facilities needs to be considered.

Hazardous Wastes:

Because soil along railroad lines is frequently found to be contaminated, the DEP has advised the proponent that removing contaminated soil, pumping contaminated groundwater, or working in contaminated media must be done under the provisions of MGL Chapter 21E/21C. DEP has further advised the proponent in its comment letter to conduct the appropriate soil and groundwater tests in advance of any construction of facilities or the placement of catenary poles. **The FEIR should summarize the results of investigations and tests conducted to date, and summarize cleanup plans, if and to the extent required by state and federal law. The report should also address concerns raised about application of herbicides along the railroad lines, identify applicable regulatory requirements and show how these will be complied with.**

Wetlands:

The DEIR does not make clear whether project structures such as switching stations will require the construction of access/maintenance roadways or the installation of supplemental electrical lines near or through wetlands. **The FEIR must address this issue. If any wetland resource areas are likely to be impacted by the project facilities, such impacts must be identified in the FEIR. The FEIR should address the significance of wetland resource areas along the railroad right-of-way (ROW), including public and private water supplies; flood control; storm damage prevention; fisheries; shellfish; and wildlife habitats.** I previously required that all resource area boundaries, applicable buffer zones and 100-year flood elevations be clearly delineated on a plan at a scale of not greater than 1 inch = 100 feet. **This was not included in the DEIR, but should be provided in the FEIR or as a technical appendix for Massachusetts. Resource areas should be surveyed, mapped, and located on the plans. Each wetland resource area should be characterized according to 310 CMR 10.00. The FEIR should explain whether the local conservation commission has accepted the resource area boundaries and any disputed boundary should be identified. To the extent that Orders of Conditions have been applied for or issued, the relevant documentation should be provided as appendices.**

Drainage:

According to the proponent, drainage will not be affected between Back Bay and South Station (MUD area). However, I

previously requested that the DEIR address the problem of the lowering of the groundwater table in this area and the DEIR failed to do this. The FEIR must fully address this issue or present monitoring data from existing Southwest Corridor wells showing this is not a problem. Is the drainage membrane not functioning in the MUD area?

The FEIR should present Best Management Practices (BMP) that will address stormwater drainage concerns in order to avoid negative impacts from the proposed facilities to water quality and wetlands in the Fowl Meadow and Ponkapoag Bog ACEC and the Canoe River ACEC. Consultation with regulatory agencies is recommended.

Energy Efficiency:

According to the DEIR, energy consumption for diesel rail is estimated at 1,406 BTU per passenger mile, whereas for the proposed electric project it is estimated at 3,167 BTU/passenger mile, or about 2.3 times as much. The energy usage of this project needs to be carefully tabulated and reviewed in order to determine if the DEIR's analysis is valid.

Historic/Archaeological Impacts:

The FEIR should identify and discuss the seven historic bridges on which catenary poles will be placed. It should provide sufficient information regarding the proposed expansion of the historic Canton Viaduct by the MBTA to also accommodate this project. I direct the proponent to complete an intensive (locational) survey at the site of the paralleling station in Attleboro and in East Foxboro as requested by the Massachusetts Historical Commission (MHC). In addition, the work proposed at the Maskwonicut Street Bridge in Sharon and the Roxbury Crossing substation site does not meet the State Archaeologists standards for a reconnaissance survey report.

Existing and Future Construction, Maintenance, and Operations:

The FEIR must address short-term and long-term impacts associated with construction, maintenance and operational activities, and evaluate to what extent they are likely to increase current impact levels. The FEIR should consider what means are available to minimize or even reduce such impacts, for example through methodology, choice of equipment and scheduling. The proponent should develop a procedure to provide notice of all non-emergency ROW work at least 24 hours in advance of any work

occurring between the hours of 7:00 pm and 7:00 am. To the extent nighttime work is necessary, the proponent should commit to measures to minimize impacts to abutting residences, such as directing lighting to within the ROW area.

Section 61 Finding/Mitigation:

The FEIR should include a separate chapter on mitigation measures, which should evaluate available mitigation measures, select those expected to address most effectively the anticipated impacts, identify the cost of proposed mitigation measures, as well as the parties responsible for assuming the cost and for implementation, and include a detailed implementation schedule.

I expect the mitigation analysis to discuss whether and to what extent the proponent intends to purchase private residences which will be seriously impacted by the proposed project.

The FEIR should include proposed Section 61 findings for required permits which specify how the proposed project will meet the goal of avoiding, minimizing and/or mitigating impacts within the scope of each permit.

Miscellaneous:

I ask the proponent to develop a fencing policy for the ROW and to specify in the FEIR where fencing will be installed, repaired or replaced. The FEIR should address the comments that express concern about safety, in particular of children in residential areas bordering on the ROW. It should also address pedestrian safety at railroad station areas along the ROW.

The FEIR should discuss the compatibility of this project with the Central Artery Project in Boston and address the conflicts outlined in MHD's comment letter. Is the proposed project compatible with extending passenger rail service beyond South Station to North Station in Boston? If so, the FEIR should detail how the projects will be coordinated in terms of equipment and scheduling. The proponent should consult with both the MHD and the MBTA in this regard.

The FEIR should address how the project might affect sensitive resource areas, habitat and species, including impacts on the safety and mobility of wildlife within ACEC's.

The FEIR should identify the areas within the ROW where additional trackage may be required to accommodate both the fast

Amtrak trains and the slower MBTA commuter trains, particularly in the vicinity of the Route 128 Station.

Distribution/Circulation:

The proponent should communicate regularly with the MEPA Unit to make sure the requirements of this scope are going to be met and past deficiencies are being corrected. I recommend that the proponent develop a written outreach plan for review by the MEPA Unit to better inform the public of project activities, including public meetings. Any formal documentation, including the FEIR, shall be circulated according to the MEPA Regulations at 301 CMR 11.24. The FEIR must provide a list of all documents prepared as part of this project, and how copies have been distributed or can be obtained (including technical appendices). It should list the comments received on the DEIR and responded to them to the extent they are within the scope of this review. I request that the proponent schedule consultation sessions in the vicinity of any substation locations being considered within Massachusetts before the FEIR is filed with the MEPA Unit. In addition, I recommend that the proponent hold a meeting within three weeks after the FEIR is filed with the MEPA Unit, preferably within a section of Boston impacted by the project. The proponent should also consider extending the review period for the FEIR, by requesting the Secretary to notice the FEIR twice in the Environmental Monitor, for a total review period of 60 days or more.

January 28, 1994
DATE

Trudy Coxe, Secretary

Comments received : Foxborough Planning Board, 11/3/93
Public Hearing Transcript - Afternoon, 11/16/93
Dept., 12/3/93
Roxbury Neighborhood Council, 12/3/93
Robert Bradley & Maria Dounelis, 12/3/93
DEM, 12/6/93
Gwendolen G. Noyes, 12/7/93
MHD/CA/T, 12/7/93

BRA, 12/7/93
U.S.Environmental Protection Agency, 12/7/93
MHC, 12/7/93
MDFA, 12/7/93
Elizabeth Houghton, 12/8/93
BTD, 12/8/93
MBTA, 12/8/93
Stephen H. Kaiser, 12/8/93
Dedham-Westwood Water District, 12/9/93
MHD, 12/9/93
Samuel Conti, 12/9/93
FRA, 12/9/93
FRA, 12/9/93
Theresa C. O'Connor-Heisler, 12/10/93
Chester Park Assoc., 12/11/93
Martha M. Meaney, 12/13/93
Neponset River Watershed Assoc., 12/13/93
Congressman J. Joseph Moakley, 12/15/93
Providence & Worcester Railroad Co., 12/15/93
William S. Kuttner, 12/21/93
Colleen Little, 12/21/93
The Northeast Corridor Initiative, 12/22/93
Stephen B. Spear, 12/26/93
DMJM/Harris, 12/27/93
DMJM/Harris, 12/28/93
Amtrak, 12/28/93
Chester Park Neighborhood Assoc., 12/30/93
Unnamed in Cranston, RI, 1/3/94
USACOE, 1/5/94
David D. Tura, 1/8/94
Conway & Londregan, 1/9/94
International Brotherhood of Electrical Workers, 1/10/94
EOTC, 1/11/94
Representative Kevin W. Fitzgerald, 1/13/94
Helen Frank, 1/14/94
Peter D. Stone, 1/17/94
Laurinda Barrett, 1/17/94
Judith W. Neurath, 1/17/94
Philip Toti, 1/18/94
DMJM/Harris, 1/18/94
Cummins Engine Co., 1/18/94
Belknap Freeman, 1/18/94
Harris, 1/19/94
Archdale Community Center, 1/19/94
Boston City Councilor Thomas M. Keane, Jr., 1/19/94

FAA, 1/20/94
MHC, 1/20/94
Melanie Greenhouse, 1/20/94
MBTA, 1/21/94
Conservation Law Foundation, 1/21/94
National Association of Railroad Passengers, 1/21/94
Miscellaneous Comment Forms, 1/21/94
Amtrak, 1/21/94
Citizens Against the Amtrak Electrification Project, 1/21/94
Miscellaneous Comment Forms, 1/24/94
DEP/NE, 1/26/94
DEP/SE, 1/28/94
DEP/Air Quality, 1/28/94
Belknap Freeman, 11/20/93
Form Letter, 11/29/93
Public Hearing Transcript - Evening, 11/16/93
George Haikalis/Albert L. Papp, Jr., 11/18/93
Cliffmont Estates Form Letter, 11/24/93
Dale Village Form Letter, 11/24/93
George Haikalis/Albert L. Papp, Jr., 11/24/93
Alan R. Cripe, 11/26/93
Kathleen Rowlings, 11/28/93
Westwood Planning Bd., 11/29/93
U.S. Environmental Protection Agency, 11/30/93
Mary Snyder, 11/30/93
MAPC, 11/30/93
Deborah Mull McDonald, 11/30/93
MHD, 11/30/93
Kenneth W. Spolsino, 12/1/93
Committee For Regional Transp., 12/1/93
Neponset R. Watershed Assoc., 12/1/93
Michael M. Shammas, 12/1/93
Friends of the Blue Hills, 12/1/93
Amtrak, 12/1/93
Rita Mandosa, 12/2/93
Leonard Singer, 12/2/93
Rep. John E. McDonough, 12/2/93
Thomas M. Donahue, 12/2/93
Gareth K. Saunders, 12/3/93
Boston Parks & Recreation Dept., 12/3/93
Michael M. Shammas, 1/25/94

TC/WTG/wg

♦ Appendix D

Memorandums of Agreement

MEMORANDUM OF AGREEMENT
SUBMITTED TO THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
PURSUANT TO 36 C.F.R. § 800.6(a)

WHEREAS, the Federal Railroad Administration (FRA) has determined that the **Northeast Corridor Improvement Project - Electrification: New Haven, Connecticut to Boston, Massachusetts** will have an effect upon properties in Connecticut listed in or eligible for inclusion in the National Register of Historic Places (Appendix 1), and has consulted with the Connecticut State Historic Preservation Officer (SHPO) pursuant to 36 C.F.R. Part 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. § 470f); and

WHEREAS, the National Railroad Passenger Corporation (AMTRAK), the project proponent, participated in the consultation and has been invited to concur in this Memorandum of Agreement.

NOW, THEREFORE, the FRA, AMTRAK and the SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

<u>Effects of Catenary on Historic Resources</u>

1. The FRA and Amtrak shall ensure that the spacing, color, design and installation of the catenary uprights and wires are carried out in accordance with "Section 106 Review Materials: Catenary Design and Catenary Spacing Adjacent to Historic Properties" prepared by Historic Resources Consultants, Inc. and dated June 10, 1994 for all sections of the project that affect historic properties listed in the final Historic Resources Technical Report for the State of Connecticut.

2. FRA and AMTRAK shall ensure that the spacing, color, design and installation of the catenary uprights and wires are carried out in accordance with "Section 106 Review Materials: Catenary Design and Catenary Spacing Adjacent to Historic Properties" prepared by Historic Resources Consultants, Inc. and dated June 10, 1994 for all sections of the project within the Haley Farm Historic Rural Landscape (Groton) and the Wilcox Road Historic District (Stonington). FRA and Amtrak shall document the Haley Farm Historic Rural Landscape (Groton) and the Wilcox Road Historic District (Stonington) to the professional standards of the Historic American Buildings Survey (to include photographs and descriptive text but not measured drawings or similar background materials). Unless otherwise agreed

to by the SHPO, the FRA and AMTRAK shall ensure that all documentation is completed prior to installation of the catenary at these locations. FRA, AMTRAK and SHPO have agreed that the design and location changes incorporated in the June 10 report and the photographic recordation efforts to be undertaken by FRA and AMTRAK will satisfactorily mitigate adverse impacts on these two historic districts.

Bridge Modifications

3. FRA and AMTRAK shall submit to the SHPO documentation evaluating alternative designs for the protective barriers to be installed on the Olive Street, Ferry Street, and Rocky Neck Park Trail bridges and shall seek approval for the preferred design(s) from the SHPO. The SHPO shall respond within 30 days of such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable design or designs. Lack of response by the SHPO within 30 days shall indicate its approval of the designs.

4. FRA and AMTRAK shall document the above three bridges to the professional standards of the Historic American Engineering Record (to include photographs and descriptive text but not measured drawings or similar background materials). FRA and AMTRAK shall consult with the Mid-Atlantic Regional Office of the National Park Service in preparing the recordation documents. Unless otherwise agreed to by the SHPO, the FRA and AMTRAK shall ensure that all documentation is completed prior to installation of the catenary at these locations.

Leetes Island Paralleling Station

5. FRA and AMTRAK will consult with the SHPO in an effort to identify measures that will mitigate adverse effects on the Route 146 Historic District arising from the height and size of the Leetes Island Paralleling Station in Guilford.

Noise/Vibration Mitigation

6. FRA and AMTRAK shall consult with the SHPO in order to identify appropriate measures to mitigate potential adverse noise/vibration impacts associated with increased rail passenger operations on the property located at 500 Noank Road (West Mystic). These measures will be consistent with noise/vibration measures developed to mitigate impacts to other similarly situated and affected properties along the northeast corridor from New Haven to Boston. Appropriate mitigation measures to address identified impacts may include: installation of ballast mats, soundproofing, noise

barriers, and, in certain circumstances, property relocation. Noise/vibration monitoring may be undertaken to estimate historic and record existing and future rail passenger service noise/vibration impacts. FRA and Amtrak will afford the SHPO an opportunity to review and comment on the data developed from any monitoring program and any mitigation measures proposed by FRA and AMTRAK.

Archeological Resources

7. If any human remains and/or grave-associated artifacts are encountered, FRA, AMTRAK and the SHPO shall consult to ensure appropriate treatment in accordance with the Policy Statement on Human Remains of the Advisory Council on Historic Preservation (Advisory Council).

8. FRA and AMTRAK shall install temporary fencing (under the supervision of a qualified archaeologist) at the Madison Paralleling Station during construction of this facility in order to ensure *in situ* preservation of the historic archaeological site located adjacent to the east side of the proposed paralleling station.

9. FRA and AMTRAK shall provide for pre-construction archaeological excavation of the proposed underground feeder line for the New London Substation to identify any buried archaeological resources.

Public Education

10. In order to enhance the public's knowledge and understanding of the 19th Century shoreline railroad corridor running through the State of Connecticut, FRA and AMTRAK shall, in consultation and cooperation with the SHPO, prepare a report documenting and describing the surviving components of the historic shoreline railroad route from New Haven to Stonington (including, but not limited to, freight and passenger stations, interlocking towers, repair facilities, signs and signalization systems, overhead and moveable bridges, underpasses and tunnels, and major interlockings). The report shall include photographs and descriptive text but not measured drawings or similar background information and shall be comparable to reports prepared for other historic transportation corridors in the State of Connecticut. The report shall be completed prior to the installation of catenary uprights and wires along the Connecticut shoreline route. To ensure widespread public access to the report, FRA and AMTRAK shall prepare 2500 bound copies of the report (250 copies of the report will be provided to the SHPO for distribution to Connecticut's libraries). The FRA, Amtrak and the SHPO will consult regarding distribution of the remaining copies). FRA and

AMTRAK shall provide a summary of the report, including pertinent photographs, to the Society of Industrial Archaeology New England Chapters Newsletter.

11. To further enhance the public's knowledge of the shoreline railroad route, the FRA and AMTRAK will use their best efforts to narrate the existing VHS-format videotape of the historic shoreline railroad route as viewed from the train engineer's perspective by identifying and describing the historic properties and facilities appearing on the videotape. Copies of the narrated videotape will be provided to the SHPO, the National Museum of American History at the Smithsonian Institution, the Valley Railroad Company, the Shoreline Trolley Museum, the Connecticut Trolley Museum, and the Windham Railway Museum.

12. FRA and AMTRAK shall consider developing, in coordination with the SHPO, a public education component that focuses upon the industrial and engineering heritage of the shoreline railroad route as part of Connecticut's Archaeology Awareness Week, 1995.

Changes to Project and Unidentified Resources

13. Should any changes occur in the project's specifications that could have an effect on properties listed in or eligible for the National Register, including but not limited to modifications to historic bridges, catenary design, catenary installation on or adjacent to historic properties, and the sitting and design of electrification facilities on or adjacent to historic properties, FRA, AMTRAK and the SHPO shall consult, prior to implementation of such changes, to devise measures to mitigate any adverse effects in accordance with 36 C.F.R. 800.5. The FRA shall notify the Council regarding any determinations of effect and mitigative measures agreed upon by the FRA, AMTRAK, and the SHPO.

14. The FRA believes the identification of properties of historic or archeological significance that was undertaken for this project is complete. Should any previously unidentified historic or archeological resources be discovered which may be affected by the project, FRA and the SHPO shall apply the National Register Criteria of Eligibility and consult pursuant to 36 CFR 800.4.

Amendment and Resolution of Disputes

15. Should any dispute arise regarding the implementation of the measures stipulated in this memorandum of agreement, the FRA, AMTRAK, and the SHPO shall consult to resolve the disagreement. Either the FRA or the SHPO may forward all

relevant information to the Advisory Council and request an amendment of this memorandum or other appropriate action.

Execution of this Memorandum of Agreement by the FRA and the SHPO, its subsequent acceptance by the Council, and implementation of its terms evidence that the FRA has afforded the Council an opportunity to comment on the Northeast Corridor Improvement Project - Electrification: New Haven, Connecticut to Boston, Massachusetts and its effects on historic properties and that the FRA has taken into account the effects of the undertaking on historic properties.

FEDERAL RAILROAD ADMINISTRATION:

By: ______________________ Date: 10/12/94

CONNECTICUT STATE HISTORIC PRESERVATION OFFICER:

By: ______________________ Date: 10/31/94

George D. Warrington, CEO - Northeast Corridor

NATIONAL RAILROAD PASSENGER CORPORATION:

By: ______________________ Date: ______

ACCEPTED for the Advisory Council on Historic Preservation:

By: ______________________ Date: 10/31/94

Donald M. Itzkoff Acting Administrator

FEDERAL RAILROAD ADMINISTRATION

MEMORANDUM OF AGREEMENT
SUBMITTED TO THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
PURSUANT TO 36 CFR § 800.6(a)

WHEREAS, the Federal Railroad Administration (FRA) has determined that the **Northeast Corridor Improvement Project - Electrification: New Haven, Connecticut to Boston, Massachusetts** will have an effect upon properties in Rhode Island listed in or eligible for inclusion in the National Register of Historic Places (Appendix 1), and has consulted with the Rhode Island State Historic Preservation Officer (SHPO) pursuant to 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. § 470(f)); and

WHEREAS, the National Railroad Passenger Corporation (AMTRAK), the project proponent, participated in the Consultation and has been invited to concur in this Memorandum of Agreement;

NOW, THEREFORE the FRA, AMTRAK, and the SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

Effects of Catenary on Historic Resources

1. The FRA and AMTRAK shall ensure that the project is carried out in accordance with "Summary of Project: New Construction, Catenary Design, and Catenary Upright Spacing Adjacent to Historic Properties," prepared by Historic Resource Consultants, Inc. and dated June 10, 1994. With regards to the placement of catenary poles at the Westerly Railroad Station and the Kingston Railroad Station, FRA and AMTRAk shall consult further with the SHPO in an order to identify pole placements that will mitigate effects on these two facilities. The FRA and AMTRAK shall also consult further with the SHPO with regards to the appropriate surface finishes to be applied to the poles and portals adjacent to historic settings. In each instance, the plans shall be submitted to the SHPO for approval and the SHPO shall respond within 30 days of such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable solution.

2. The FRA and AMTRAK shall consult with the SHPO to determine the kind of photographic recordation required for the following historic properties and shall cause such recordation to the completed. Unless otherwise agreed to by the SHPO, the FRA and AMTRAK shall ensure that all documentation is completed and accepted by the SHPO prior to

installation of the catenary at these points:

Westerly Station, Westerly
Shannock Historic District, Richmond
Kenyon Historic District, Richmond
Kingston Station, South Kingston
East Greenwich Historic District, East Greenwich
Downtown Providence Historic District, Providence

Bridge Modifications

3. The FRA and AMTRAK shall ensure that the design of the new bridge in the Kenyon Historic District is compatible in size, scale, and materials with the surrounding historic district. The plans for the bridge shall be submitted to the SHPO for approval. The SHPO shall respond within 30 days of such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable design. Lack of response by the SHPO within 30 days shall indicate its approval of the plans.

4. The FRA and AMTRAK shall submit to the SHPO documentation evaluating alternative designs for the protective barriers to be installed on the following historic bridges and shall seek approval for the preferred design(s) from the SHPO. The SHPO shall respond with 30 days of such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable design or designs. Lack of response by the SHPO within 30 days shall indicate its approval of the design(s):

   West Street Bridge, Westerly
   Main Street Bridge (RIDOT, No. 372), South Kingston
   Hunts River Road Bridge (RIDOT No. 7), North Kingston
   Greenwood Railroad Bridge, (RIDOT, No. 2), Warwick
   Central Street Pedestrian Viaduct, Central Falls.

5. Prior to the installation of the protective barriers on the bridges identified in section 4 above, the FRA and AMTRAK shall consult with the SHPO to determine what level and kind of recordation is required for each bridge. Unless otherwise agreed to by the SHPO, FRA and AMTRAK shall ensure that all documentation is completed and accepted by the SHPO prior to the start of work on the bridge.

6. The FRA and AMTRAK shall ensure that the attachment of the catenary to the Blackstone River Bridge conforms with the specifications in "Installation of Catenary on Blackstone River Bridge," prepared by Historic Resource Consultants, Inc. and dated June 10, 1994. FRA, AMTRAK, and the SHPO shall consult regarding recordation as specified in the

proceeding paragraph.

Archeological Resources

7. The FRA and AMTRAK shall ensure that Rhode Island Historic Cemetery #4 is stabilized in accordance with the recommendations in "Archeological Survey Technical Report," prepared by Public Archeology Survey Team and dated June, 1994.

8. If any human remains and/or grave-associated artifacts are encountered, the parties shall consult to ensure appropriate treatment in accordance with the Policy Statement on Human Remains of the Advisory Council on History Preservation (the Council) and "An Act Relating to Historic Cemeteries" (Rhode Island Bill 92-H 9481).

New Construction

9. Prior to construction at the sites, the FRA and AMTRAK shall submit documentation showing the location and design of the Exeter Paralleling Station and the Elmwood Paralleling Station to the SHPO for its approval. The SHPO shall respond with 30 days of receipt of any such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable design. Lack of response by the SHPO within 30 days shall indicate its approval of the plans.

Changes to Project and Unidentified Resources

10. Should any changes occur in the project's specifications that could have an effect on properties listed in or eligible for the National Register, including but not limited to modifications to historic bridges, catenary design, catenary installation on or adjacent to historic properties, and siting and design of electrification facilities on or adjacent to historic properties, FRA, AMTRAK and the SHPO shall consult, prior to the implementation of such changes, to determine the effect of the changes on historic properties and to devise measure to mitigate any adverse effects in accordance with 36 CFR 800.5. The FRA shall notify the Council regarding any additional determinations of effect and mitigative measures agreed upon by the FRA, AMTRAK, and the SHPO.

11. The FRA believes the identification of properties of historic or archaeological significance that was undertaken for this project is complete. Should any previously unidentified historic or archeological resources be discovered which may be affected by the project, the FRA and the SHPO shall apply the National Register Criteria of

Eligibility and consult pursuant to 36 CFR 800.4.

Amendment and Resolution of Disputes

12. Should any dispute arise regarding the implementation of the measures stipulated in this Memorandum of Agreement, the parties shall consult to resolve the disagreement. Should the FRA determine that the dispute cannot be resolved, the FRA shall forward all relevant documentation to the Council and request an amendment of this Memorandum or other appropriate action.

Execution of this Memorandum of Agreement by the FRA and the SHPO, its subsequent acceptance by the Council, and implementation of its terms evidence that the FRA has afforded the Council and opportunity to comment on the **Northeast Corridor Improvement Project - Electrification: New Haven, Connecticut to Boston, Massachusetts** and its effects on historic properties and that the FRA has taken into account the effects of the undertaking on historic properties.

FEDERAL RAILROAD ADMINISTRATION:

By: Donald M. Itzkoff Date: 10/31/94
Donald M. Itzkoff Acting Administrator

RHODE ISLAND STATE HISTORIC PRESERVATION OFFICER:

By: Frederick C. Williamson Date: 9/28/94
Frederick Williamson, State Historic Preservation Officer

NATIONAL PASSENGER RAILROAD CORPORATION:

By: ________________ Date: 10/31/94
George D. Warrington, CEO - Northeast Corridor

ACCEPTED for the Advisory Council on Historic Preservation:

By: ________________ Date: ________________
Robert Bush, Executive Director

MEMORANDUM OF AGREEMENT
SUBMITTED TO THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
PURSUANT TO 36 CFR § 800.6(a)

WHEREAS, the Federal Railroad Administration (FRA) has determined that the **Northeast Corridor Improvement Project - Electrification: New Haven, Connecticut to Boston, Massachusetts** will have an effect upon properties in Massachusetts listed in or eligible for inclusion in the National Register of Historic Places (Appendix 1), and has consulted with the Massachusetts State Historic Preservation Officer (SHPO) pursuant to 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. § 470f); and

WHEREAS, the National Railroad Passenger Corporation (AMTRAK), the project proponent, and the Boston Landmarks Commission (BLC) participated in the Consultation and have been invited to concur in this Memorandum of Agreement;

NOW THEREFORE, the FRA, AMTRAK, the SHPO, and BLC agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

<u>Roxbury Substation</u>

1. The FRA and AMTRAK shall submit documentation to the SHPO and BLC showing the site and design of the Roxbury Substation. If the facility is located within a building that is individually listed in or eligible for listing in the National Register of Historic Places or is a contributing building within a listed or eligible district, the FRA and AMTRAK shall ensure that the construction of the facility is consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (1990) and shall submit the plans to the SHPO and BLC. The SHPO, on behalf of itself and the BLC, shall respond within 30 days of receipt of any such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable design pursuant to 36 CFR 800.5. Lack of response by the SHPO within 30 days shall indicate approval by the SHPO and BLC of the plans.

<u>Effects of Catenary on Historic Resources</u>

2. The FRA and AMTRAK shall ensure that the project is carried out in accordance with "Summary of Project: New Construction, Catenary Design, and Catenary Upright Spacing Adjacent to Historic Properties," prepared by Historic

Resource Consultants, Inc., and dated June 10, 1994. The FRA and AMTRAK shall consult with the SHPO to determine the kind of photographic recordation required for the following historic properties and shall cause such recordation to be completed. Unless otherwise agreed to by the SHPO, the FRA and AMTRAK shall ensure that all documentation is completed and accepted by the SHPO prior to installation of the catenary at these points:

Attleboro Stations
Sharon Station
Canton Junction Station

Bridge Modifications

3. Prior to any construction at the Maskwonicut Street bridge, FRA and AMTRAK shall submit the plans to the SHPO for its approval, including a description of any addition or replacement of fill, grading, and installation of guardrails in connection with the adjacent stone arch over Beaver Brook, as well as procedures for protecting the stone arch from damage during construction. The SHPO shall respond within 30 days of such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable design pursuant to 36 CFR 800.5. Lack of response by the SHPO within 30 days shall indicate its approval.

4. Prior to any construction affecting the Canton Viaduct, the FRA and AMTRAK shall submit plans for attaching the catenary on the viaduct to the SHPO for its approval. The SHPO shall respond within 30 days of such submission by indicating approval, requesting additional documentation, or requesting further consultation in order to arrive at an acceptable design. Lack of response by the SHPO within 30 days shall indicate its approval of the design.

5. Should a new protective barrier be necessary for the Mt. Hope Footbridge, the FRA and AMTRAK shall install a chain-link barrier similar to the one currently in place.

Archeological Resources

6. If any human remains and/or grave-associated artifacts are encountered, the FRA, AMTRAK and the SHPO shall consult to ensure appropriate treatment in accordance with the Policy Statement on Human Remains of the Advisory Council on History Preservation (the Council), as well as applicable Massachusetts laws (i.e., Massachusetts General Laws, Chapter 38, section 6B; Chapter 9, section 27C; Chapter 7, section 38A; and Public Law 101-601, the Native American Grave Protection and Repatriation Act of 1990).

Changes to Project and Unidentified Resources

7. Should any changes occur in the project's specifications that could have an effect on properties listed in or eligible for the National Register, including but not limited to modifications to historic bridges, catenary design, catenary installation on or adjacent to historic properties, and siting and design of electrification facilities on or adjacent to historic properties, FRA, AMTRAK, and the SHPO shall consult, prior to the implementation of such changes, to determine the effect of the changes on historic properties and to devise measures to mitigate any adverse effects in accordance with 36 CFR 800.5. The FRA shall notify the Council regarding any additional determinations of effect and mitigative measures agreed upon by the FRA, AMTRAK, and the SHPO.

8. The FRA believes the identification of properties of historic or archeological significance that was undertaken for this project is complete. Should any previously unidentified historic or archeological resources be discovered which may be affected by the project, the FRA and SHPO shall apply the National Register Criteria of Eligibility and consult pursuant to 36 CFR 800.4.

Amendment and Resolution of Disputes

9. Should the SHPO object within 30 days to any plans provided for review pursuant to this agreement, the FRA and AMTRAK shall consult with the SHPO to resolve the objection. If the FRA determines that the objection cannot be resolved, the FRA shall request the further comments of the Council pursuant to 36 CFR 800.6(b). Any comments provided in response to such a request will be taken into account by the FRA in accordance with 36 CFR 800.6(c)(2) with reference only to the subject of the dispute; FRA's responsibility to carry out all actions under this agreement that are not the subjects of the dispute remain unchanged.

Execution of this Memorandum of Agreement by the FRA and the SHPO, its subsequent acceptance by the Council, and implementation of its terms evidence that the FRA has afforded the Council an opportunity to comment on the **Northeast Corridor Improvement Project - Electrification: New Haven, Connecticut to**

Boston, Massachusetts and its effects on historic properties and that the FRA has taken into account the effects of the undertaking on historic properties.

FEDERAL RAILROAD ADMINISTRATION

By: _______________ Date: 10/31/94
Donald M. Itzkoff Acting Administrator

MASSACHUSETTS STATE HISTORIC PRESERVATION OFFICER:

By: Judith B. McDonough Date: 10/24/94
Judith B. McDonough, State Historic Preservation Officer

NATIONAL PASSENGER RAILROAD CORPORATION:

By: _______________ Date: 11/3/94
George D. Warrington, CEO - Northeast Corridor

BOSTON LANDMARKS COMMISSION:

By: Ellen Lipsey Date: 10/27/94
Ellen Lipsey, Executive Director

ACCEPTED for the Advisory Council on Historic Preservation:

By: _______________ Date: _________
Robert Bush, Executive Director

♦ Appendix E

List of Agencies, Organizations, and Persons from Whom Comments were Received on the DEIS/R

APPENDIX E
LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS FROM WHOM COMMENTS WERE RECEIVED ON THE DEIS/R

Aannan, Matthew J.
Algiere, Dennis - State Senator
Allen, Scott
Alling, Jan
Alternative Rating Systems
Amtrak
Anderson, Karen
Anderson, Keith
Anderson, Mary
Andrews, Eleanor & William
Archdale Community Center
Avedy, Melissa
Avery, Arnold W.
Avery, Bruce
Avery, Dana F.
Avery, George A.
Avery-Shammas, Nancibeth
Baker, Daniel
Bakewell, Henry P.
Baldwin, Joanne T.
Bardong, Charles
Barrett, Linda
Bates, Paul
Baudouin, Daniel
Bayreuther Boat Yard
Beal, Shirley C.
Becker, Jason C.
Bentley, David C.

Berke, Jeffrey S.
Bertoline, Joseph
Blackstone River Valley Commission
Blade, Catherine
Bliven, Sarah F.
Blundell, Wendy
Boats Incorporated
Boston Landmarks Commission
Boston Parks & Recreation Department
Boston Redevelopment Authority
Boston Transportation Department
Branford, Town of - Selectmen
Breen, Jessica Morrissey
Breen, Chris
Breen, Bridget
Brooks, John
Brown, James
Brown, Stephen T.
Buckley, James
Bullis, Patricia S.
Burfoot, Susan
Burton, L'ana & John
Carchedi, Jerry
Cannon, William
Carter, Barbara
Carvevale, Shelly
Cattanch, Suzanne
Ceddon, Thomas, M.D.
Chacho, Shirley
Chaffe, John - U.S. Senator
Chauson, Kenneth
Chester Park Neighborhood Association
Citizens Against Amtrak Electrification Project

Citizens Transportation Action Campaign
Cochran, Amy
Cole, Paula
Cole, Stuart G. Cole
Coleman, Winnie
Committee for Regional Transportation
Conrail
Conservation Law Foundation
Conti, Fred A.
Conti, Samuel
Conway & Londregan, PE
Cook, Catherine W. - State Senator
Coolen, Mark
Cordero-Avila, Julie
Covin, Regina
Cranmore, Fitzgerald & Meaney - Company
Creech, Deborah
Cripe, Alan R.
Crocker's Boat Yard
Crotty, Ann
Crouch, CDR Calvine E.
Crowley, Patrick
CT Department of Environmental Protection
CT Department of Transportation
CT Fund for the Environment
CT Historical Commission
CT Marine Trades Assoc.
CT Public Transportation Commission
CT Siting Council
Culfax, Inc.
Cummin's Engine Co.
Danoff, Christina
Darling, Jack

Davies, Catherine
Dedham-Westwood Water District
Deep River Marina
Dempsey, Roy
Devlin, Mark
Dicesare, Rocca
Dickinson, Roger H.
Dimeco, Robert
Dock, Elizabeth M.
Doherty, Bernard
Dominy, Beryl & Cheryl
Donahue, Thomas
Donnarummo, Carlene F.
Dores, Peter
Dounelis, Maria
Doyle, G.
Duff, William K.
Duffy, C.
Duncklee, Inc.
East Greenwich, Town of
East Lyme, Town of - Conservation Commission
Eatin, Richard S.
Eddins, Heidi
Eleanor M. Burdick
Elliot, Jasmine
Ellis, Mrs.
Essex Island Marina
Faulsie, Vincent
Federal Aviation Administration
Federal Emergency Management Agency
Fenn, Wallace & Carol
Ferzoc, Danny J.
Filbey, William

Fisher, Deborah R.
Fitzgerald, Kevin - Representative.
Fleming, J. Raymond
Foote, Jerry L.
Fort Rachel Marine Service
Fortune Plastics
Frank, Helen
Freeman, Belknap
Freitas, Vernon
Friends of the Blue Hills
Fromer, Robert
Fuhier, William H.
Gammet Flemming, Inc.
G. M. Gannon Co., Inc.
Gales Ferry Marine, Inc.
Geary, Joseph E.
George Mann Co., Inc.
Gerrard, Robert
Ghoya, Gurudola
Gibbs, James
Gibson, Jonathan
Gillespie, Peter
Glaser, Zory, R.
Glynn, Katherine
Goettlich, Paul W., II
Gillepie, Peter
Goggin, Sherwin
Golden, Ceri
Golden, Sherry
Golub, Audrey
Goodrich, Charles C.
Goodridge, Claudia
Greater Providence Chamber of Commerce

Greenfeld, David
Greenhouse, Melanie
Gross, Sydney & Roger
Groton, City of
Gun, Joan M.
Haikalis, George
Hainline, Amy L.
Hamilton, Bruce
Hardiman, George
Harris, Ruby
Harsch, William W.
Harteers, Kristin & Bob
Heisler, Joe
Hellier Yacht Sales
Hensler, Suzanne - State Representative
Hill, Dora
Holby, Frank M.
Houghton, Elizabeth
House, Kelly
House, A. E., Jr.
Hunt, Rowland
Hyland, Melissa
International Brotherhood of Elec. Workers
Jeanneau (N.A.)
Jensen, Oliver
JOCR Research
Johnson Brothers Co.
Johnson, Geoffrey
Johnson, Zach
Johnstone Partnership
Judge, Robert J.
Kaiser, Stephen
Keane, Thomas M., Jr. - Councilor

Kehoe, Marie Louise - Rep.
King, John E.
Knowles, Nancy J.
Kuttner, William S.
La Colla, Patricia
Ladd, Anne
Lage, Janet
Lambert, Mary
Laroche, Mark
Lasky, William T.
Lattero, Barbara
Leake, Geoffrey H.
Learned, Barbara
Ledge Light Health District
Lesnick, James
Lewis, Karen
Lewis, Ron
Lillquest, Robert
Little, Collen
MA Department of Food & Agriculture
MA Department of Environmental Management
MA Executive Office of Trans. & Const.
MA Highway Department
MA Highway Dept./Central Artery/Tunnel Project
MA Historical Commission
MA Department of Environmental Protection
Machtley, Ron - U.S. Representative
Maciejko, Thomas
Maclean, Hugh
MacNeil, Jack M.
Madden, Katherin
Madden, Marc
Madison Racquet Club

Malckow, Carolyn
Malony, John
Mancosh, Douglas
Mandosa, Helen
Mandosa, Rita Sabina
Manning, Brian H.
Marcus, George & Paula
MARINPRO
Marks, Eugenia
Mashantucket Land Trust
Maynard, Joel & Linda
Mazzalupo, David
Minacapilli, Patricia
Massachusetts Bay Transportation Authority
McCarthy, Ed
McDonald, Deborah
McDonough, John E. - Representative
McDowell, Tim
Mcelhenny, Bernie & Pam
McLaughlin, Addrienne
McLaughlin, Neil
Meaney, Joseph
Meaney, Kathleen
Meaney, Martha
Melanson, Donna E.
Metropolitan Area Planning Council
Milano, Anthony
Minson, Beatrice
Minson, Beatrice E.
Moakley, Joseph - U.S. Representative
Montague, Peter
Moctusik, Robert
Mortriez, David

Munger, G. R.
Munger, Susan H.
Murray, William
Musante, James J.
Musen, Steven
Mystic Chamber of Commerce
Mystic Environmental Design
Mystic Marine Basin
Mystic Nautical Heritage Society
Mystic River-Whitford Brook
Mystic Seaport Museum
Nagele, Rick
Narragansett Electric Company
National Association of Railroad Passengers
Neponset River Watershed Association
Neurath, Judith W.
New Haven City Planning Department
New London, City of
Niering, William A.
Nily, Ira
Noank Historical Society
Noank Zoning Commission
Noel, Mr. & Mrs. A. E.
NORAD
North Kingstown, Town of
Northeast Corridor Initiative
Northeast Utilities
O'Brien, Kathleen & Gerard
O'Brien Law Offices
O'Connor-Heisler, Theresa C.
O'Leary, Stephen
O'Leary, Patricia
Olanoff, Steven

O'Martin, Margaret
Ogren, Edward
Old Lyme Planning Commission
Old Lyme, Town of
Oldham, Neild B.
Oliver, Margaret
Otterness, Naomi
Ouaglin, Paul
Ouelette, Thomas
Paolini, Albert
Papp, Albert L., Jr.
Parent from Sacred Heart Parish
Parker, Edmund
Pascuzzi, Carmen Anthony
Pawtucket, City of
Peck, Albert
Pell, Claiborne - U.S. Senator
Peters, Melodie - Senator
Petrillo, Anthony
Pilchowski, George
Pizzone, John
Porcodin, Myron
Porter, Eliot
Porter, Marcia W.
Porter, Robin
Prior, Dennis
Prior, Michael D.
Providence & Worcester Railroad
Providence Foundation
Pulley, Joyce
Purcell, Leo
Quebecor Printing
Quigley, Christine

Raikes, Tana
Reddick, Delin
Reed, Jack - U.S. Representative
Reiber, Bruce
Repass, Jim
Resnikoff, Joyce Olsen
Reynolds, Linda
RI Airport Corporation
RI Association of Railroad Passengers
RI Audobon Society
RI Department of Environmental Management
RI Dept. of Economic Development
RI Department of Transportation
RI Historical Preservation Commission
RI Office of Strategic Planning
RI Port Authority & Economic Development Corp.
Rice, Jim
Rice, Leslie
Rice, Theo C.
Richards, Betty
Richartz, Nancy & Fred
Rieber, M. Bruce
Riendeau, John
Rivers, Roy
Robbind, Laura M.
Robinson, Katherine H.
Rolfes, Mike & Mary
Romer, Robert
Ronohagen, Susan
Rowlings, Kathleen
Roxbury Neighborhood Council
Salvatore, Karen
Sanders, Gareth - Councilman

Save the Bay
Sayers, Mrs. & Mrs. Richard
Scheidesha, Kathleen
Schiller, Barry
Scovib, Jeff
Scully, Thomas D.
Seafreeze, Ltd.
Seaport Marine
Seiler, Linda
Shammas, Michael M.
Sharon, Town of
Shatterfeld, Julie
Shelton, Oscar K.,Jr.
Shoemaker, Howard
Simmons, Jane
Simmons, Robert R. - Representative
Simon, Robin
Simpson, Jean & Don
Singer, Leonard M.
Smith, Jane G.
Smith, Robin R.
Smith, Tracy H.
Snyder, Mary
South Central CT Regional Water Authority
Southeastern CT Council of Governors
Sparaco, Ralph F.
Spear, Stephen & Rochelle
Spolsino, Kevin W.
Steinberg, Barry M.
Steel, Jack
Stevens, Jonathan
Stone, Peter D.
Stonington Shellfish Commission

Storrow, Alisa
Stul, Tad
Sukkar, Adi
Sullivan, Barbara
Sullivan, Catherine
Sundlun, Bruce - Governor
Thatcher, William
Thomson, John
Tilcon CT, Inc.
Torchette, Charles
Toti, Phil
Train Riders of Northeast
Tura, David D.
Tyler, Gayle
Tyler, Thomas
U.S. Army
U.S. Coast Guard
U.S. Environmental Protection Agency
Victoria, William A.
Vogel, Linda
Walsh, Allison
Wagner, Thomas
Walton, Robert P.
Warburton, Nancy H.
Warner, David C.
Waterford, Town of
Web, Darlene
Weinberger, Kathy
Welsh, Maura A.
Welsh, Robert I., Jr.
Wesson, David H.
Westwood, Town of, Planning Board
White, Janet

Whitman, Ernest
Wiben, Richard G., Jr.
Wilds, Nina
Wiley, Marie Tyler
Williams, Frank
Wladerman, Michael A.
Wong, Jennifer
Zazami, Eva
Zeiller, Helen
Zhang, Jimin

♦ APPENDIX F

List of Preparers and Reviewers

APPENDIX F
LIST OF PREPARERS AND REVIEWERS

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL RAILROAD ADMINISTRATION

Preparers:

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William Fashouer

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Reviewers:
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John McGuiggan
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Richard Domas

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Lawrence Berkowitz
Brenda Corbett
Kenneth DuBuque
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Paul Valihura, PhD

Leslie Bordonaro
Jenny D. Jones
Penny Norris
Maria Sampogna

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William Voulgaris
Laura Briggs

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Preparers:

David A. Towers
Yuki Kimura

Reviewers:

Hugh J. Saurenman, PhD
Carl E. Hanson, PhD

ROY F. WESTON, INC.

Preparers:

James A. S. Philcox
Matthew Goldman
John Hizny

Reviewer:

Robert W. Pease, Jr.

K M CHNG ENVIRONMENTAL, INC.

Preparers:

A. D. Goldman
P. J. Moynihan

Reviewers:

K. M. Chng
J. N. Grillo

PUBLIC ARCHAEOLOGY SURVEY TEAM, INC.

Preparers:

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Mary G. Soulsby
Robyn Beausoliel
Corine Chalumeau
Julie Hartman

THE SMART ASSOCIATES ENVIRONMENTAL CONSULTANTS, INC.

Preparer:

James R. Fougere

Reviewer:

Melissa B. Smart

♦ APPENDIX G

Section 4(f) Statement for Siting of the Kingston Paralleling Station

APPENDIX G
SECTION 4(f) STATEMENT

INTRODUCTION

The National Railroad Passenger Corporation (Amtrak) has proposed to locate an electrical facility called a paralleling station adjacent to its tracks near the Kingston, RI. Amtrak's current right-of-way is not wide enough in this location to accommodate this facility, and Amtrak is seeking to acquire approximately 0.1 acre of property from the Great Swamp Wildlife Management Area (GSWMA) to expand its right-of-way to accommodate this facility.

Amtrak's proposal is part of the Northeast Corridor Improvement Project (NECIP) which is funded by the Federal Railroad Administration (FRA). The proposed acquisition of property from the GSWMA would constitute the use of a portion of this wildlife refuge of State or local significance. FRA, in consultation with the Rhode Island Department of Environmental Management (RIDEM), has determined that there are no feasible or prudent alternatives to this use and all appropriate planning to mitigate harm has been incorporated into the proposed project's design.

BACKGROUND

The NECIP is an ongoing comprehensive program, authorized by Congress in the Railroad Revitalization and Regulatory Reform Act of 1976, with the goal of improving intercity rail passenger service between Washington, DC, through New York City, NY, to Boston, MA. To date, over $3.0 billion has been invested as part of NECIP in upgrading the rail infrastructure of the NEC with significant improvements to intercity rail service provided by Amtrak and to commuter rail passenger service provided by various public agencies.

The current focus of NECIP is on those remaining improvements between New York City and Boston necessary to reduce intercity express train trip times between those two cities, with intermediate stops, to less than 3 hours, which is the statutory goal.

One of the major uncompleted elements of NECIP that Amtrak has identified as necessary to meet the statutory trip time goal is the extension of electric traction between New Haven and Boston. Presently, Amtrak trains operating over the NEC between Washington, DC, and New Haven, CT, are powered by electricity transmitted to the trains by overhead transmission lines referred to as catenary. New Haven is the northern limit of Amtrak's electrified rail system, and NEC trains continuing on to Boston must change there to diesel locomotives.

Electrically powered trains have operating characteristics (e.g., maximum speed, acceleration and deceleration rates, reliability, and cost of maintenance) that make them superior to other forms of railroad traction presently in service. In the context of improved rail passenger service between Boston and New York City, electric traction also addresses site specific operational concerns. The first is the trip time delay associated with switching from non-electric (diesel) locomotives to electric locomotives at New Haven. The second is the severe capacity constraints in the New York City railroad tunnels and at Pennsylvania Station which are exacerbated by non-electric trains using electric third rail. The third is the ability to improve Amtrak equipment utilization by improving the efficiency of Washington to Boston through service. In addition, electrically powered railroads offer energy and air quality advantages to available alternatives.

Since 1991, Congress has appropriated a total of $292.8 million earmarked for the proposed electrification project, which amounts to 15 percent of its expected cost. Amtrak has awarded a contract to a consortium of construction, engineering, and electric traction firms, to design and build the proposed electrification improvements. Presently, the design of this system is at the 60 percent completion stage. Amtrak estimates that, with the necessary permits and approvals, construction can begin in the spring of 1995 and will take approximately three years.

A combined draft environmental impact statement and draft environmental impact report[1] (DEIS/R) on the proposed electrification project was published by FRA in October 1993, and FRA is presently preparing the FEIS/R. Subsequent to the release of the DEIS/R, Amtrak's engineers concluded that the design of the electric traction system required that the subject paralleling facility must be located in the GSWMA.

GREAT SWAMP MANAGEMENT AREA

The proposed Kingston Paralleling Station would be located within the boundaries of the GSWMA in South Kingstown, RI (see Figure G-1). The GSWMA includes approximately 3,349 acres of land in the towns of South Kingstown and Richmond, RI. The management area was purchased and developed with Pittman Robertson funding from the USFWS. The GSWMA is currently owned and maintained by RIDEM, also using Pittman Robertson funding.

The GSWMA was originally founded in 1950 with the acquisition of 2,355 acres from the Rowland Hazard Estate and 325 acres from A.E. Lownes. Additional parcels were added as they became available, including a parcel of land from the Butson Farm circa 1973. The current 3,349 acres are comprised of approximately 27 percent forests, 67 percent wetlands, 3 percent agricultural land, and 3 percent other uses (Tefft, 1993).

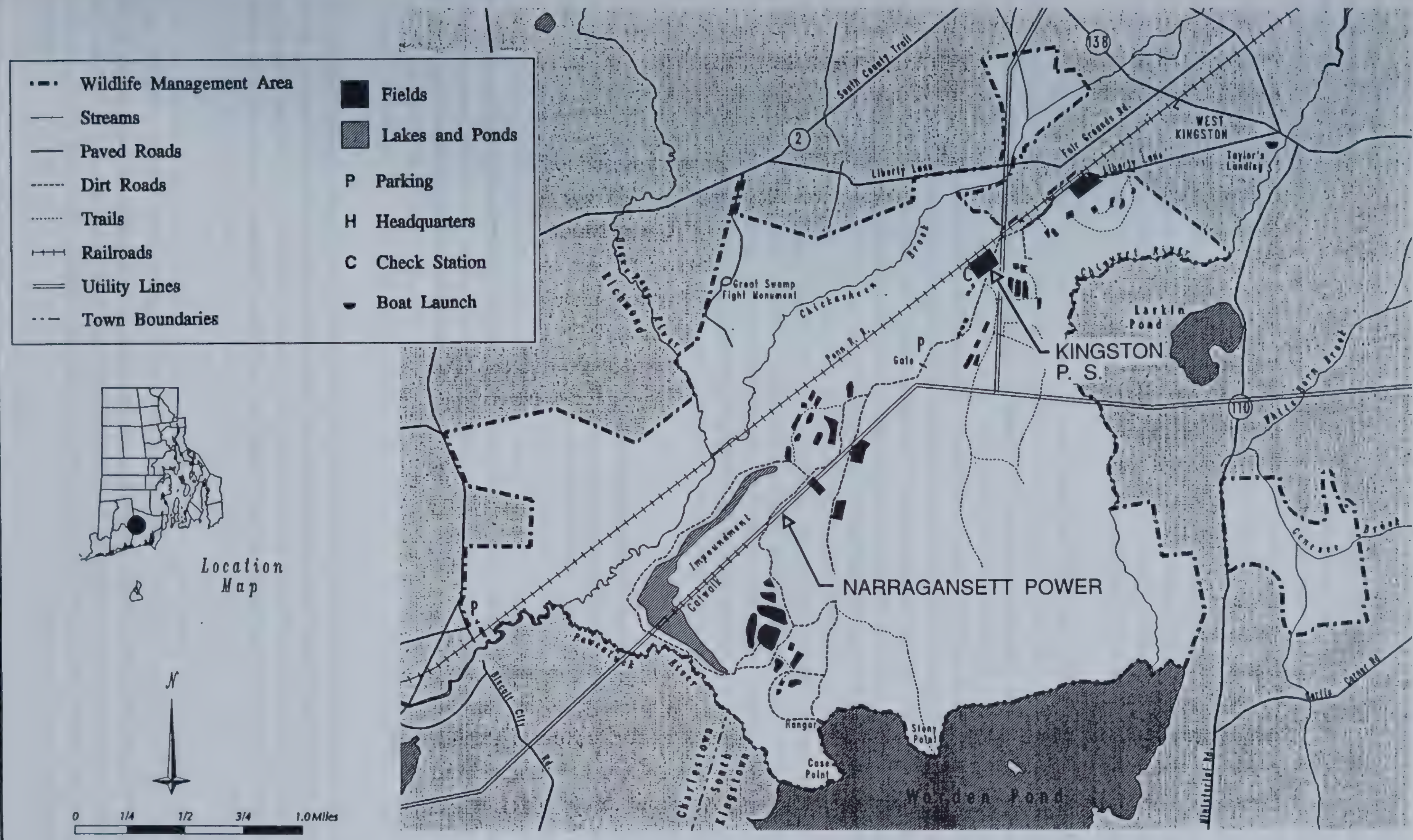
The GSWMA was purchased to function as a wildlife management area and contains several buildings that house the field offices and laboratory of the RIDEM Wildlife and Freshwater Fisheries Section. Facilities at the area include a public parking area, a hunter check station, and several gravel roads and trails. Access to the site is from Liberty Lane off Rhode Island Route 138 or via a gravel road off Rhode Island Route 2. Access to most of the area's gravel roads is restricted by gates. The area is used extensively for hunting various game birds and mammals, freshwater fishing, hiking, and biking. Horseback riding and bicycling are also allowed on the gravel roads. In addition, there is a public shooting range within the area.

Among the unusual characteristics of the GSWMA are the wide variety of birds and mammals, including: cottontail rabbits, gray squirrels, white-tailed deer, fox, coyotes, raccoons, muskrats, minks, ospreys, ruffed grouse, ring-necked pheasants, wild turkeys, bobwhite, woodcock, various ducks, and numerous other nongame species of songbirds, small mammals, amphibians, reptiles, and fish. The 138-acre manmade Great Swamp Impoundment provides excellent wildlife habitat including deep and shallow marsh, vegetated and non-vegetated open water, aquatic shrubs, and shrub swamp.

The Pawcatuck Basin underlying the study area is an interconnected system of 10 aquifers providing 8.1 million gallons of water per day to an estimated 87,000 people. The Pawcatuck Basin has been designated as a sole source aquifer by EPA and as such is subject to protection under the EPA sole source aquifer program.

The Great Swamp Fight Site is a historic site located in the northwest corner of the management area commemorating the scene of a battle between early European settlers and Narragansett tribe members. Although a portion of the subsurface soils has been previously disturbed, the proposed paralleling station is located in an

[1]Preparation of an environmental impact report is required by the Massachusetts Environmental Policy Act. Consistent with the policy of the Council on Environmental Quality and the Department of Transportation, a joint environmental document is being prepared.



GREAT SWAMP WILDLIFE MANAGEMENT AREA

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure G-1

area described as archaeologically sensitive due to the extensive resources afforded by the surrounding Great Swamp. Accordingly, a locational (Phase I) survey was conducted with the excavation of three test pits in the planned location of the paralleling station. No artifacts were recovered; therefore, based on the lack of evidence and previous below-ground disturbance, there is little chance for finding intact archaeological remains in the project area. The proposed paralleling station would not impact any known historic or archaeological sites.

Two permanent easements are held by other owners. The Narragansett Electric Company holds easements for a substation within, and power lines across the GSWMA (see Figure G-1). These easements cover approximately 35.2 acres of land within the management area. The existing Amtrak right-of-way (ROW) is approximately 3.3 miles in length and runs from northeast to southwest across the management area, separating the northwesterly quarter of the site from the remaining three quarters.

DESCRIPTION OF THE PROPOSED PROJECT

Amtrak 's proposed electrification project is composed of a number of elements that include:

- An overhead catenary system (OCS) composed of wires suspended over the railroad tracks and generally supported by pairs of steel poles, approximately 31 feet high, placed on either side of the railroad tracks. The poles would support a cantilevered arm from which the wires are suspended. Each set of poles would be spaced approximately 200 feet from the next pair tangent along the track, and closer along curved track sections.

- Substations and utility supplies to provide electricity from the local utility company to the substation via a tie-in from the utility's transmission network. The utility lines consists of either overhead or underground wires from local transmission lines to the new substation. The substation "steps down" or converts the 115,000 volts (115 kV) on the utility's power line to the 25 kV levels via a transformer at the substation. The 25 kV feed is then connected to the OCS for use by the locomotive.

- Switching stations and paralleling stations (intermediate power supply points for the OCS) are smaller in scale than substations and contain transformers that connect the feeder to the catenary. By employing these smaller facilities, fewer substations and utility tie-ins are needed, since power can be carried farther down the rail line than if no feeder and intermediate supply points are used.

The Kingston Paralleling Station at milepost (MP) 157.11 will consist of an autotransformer and switchgear to equalize voltage between the two tracks and to regulate voltages in that portion of the electric traction system between the Richmond, RI, Switching Station at MP 150.15 and the Exeter, RI, Paralleling Station at MP 161.78.

ALTERNATIVES CONSIDERED

Notwithstanding clear Congressional direction to FRA to upgrade the existing Northeast Corridor main line by extending electric traction between New Haven and Boston, FRA evaluated a wide range of alternatives, first as part of the Programmatic Environmental Impact Statement (PEIS) prepared for NECIP in 1978 and then as part of the environmental review of the proposed electrification project. The following summarizes the major alternatives reviewed.

Route Alternatives

The PEIS considered two alternative routes between New Haven and Boston as candidates for upgrading as part of NECIP. The NECIP program decision made in 1978 included the selection of the existing NEC main line between New Haven and Boston, referred to as the Shore Line. Since that decision, over $1.1 billion has been invested in upgrading the Shore Line Route.

The scope of the proposed project and related environmental reviews have a more narrow focus than the PEIS. Their scope is to evaluate alternatives to the extension of electric traction to the Shore Line. However, route alternatives were reviewed to determine whether any change had occurred since the PEIS that warranted a reassessment of the PEIS decision to upgrade the Shore Line.

Three alternative routes between New Haven and Boston were reviewed:

- the Inland Route through Hartford, CT, Springfield, MA, and Worcester, MA
- the Airline Route through Middletown, CT, Willimantic, CT, Woonsocket, RI, and Walpole, MA
- the Shore Line realignment between Old Saybrook, CT, and Westerly, RI

In reviewing these alternatives, no change in circumstance was identified that established an alternative route as clearly superior from an environmental standpoint to the program decision made by FRA in 1978 to improve the Shore Line. The different alternative routes would lessen or eliminate the impacts associated with NECIP in certain specific areas. This would be offset by the significant impacts associated with construction of these new routes as well as the transference of many of the operational impacts to other areas. In addition, the time required to obtain necessary permits and approvals, and to construct alternative routes, would substantially delay the environmental benefits that will be derived from high-speed rail service between Boston and New York City. Moreover, each of the route alternatives has significantly higher capital costs. At this time, the necessary capital to implement these alternatives is not available and it does not appear likely that it will become available in the foreseeable future. This calls into question the feasibility of these alternatives.

As a consequence, FRA concluded that further consideration of route alternatives is unnecessary. The detailed analysis of alternatives carried forward into the FEIS/R on electrification addressed alternative approaches to providing improved intercity passenger service over the Shore Line.

Technology Alternatives

FRA reviewed a wide range of possible alternatives to extension of electric traction as proposed by Amtrak. These included a "do-nothing" scenario, as well as a scenario under which existing state-of-the-art non-electric rail equipment would be used, and a scenario that looked at potential improvements on the present state of the art.

The analysis of the Proposed Action and the No-Build Alternative scenarios demonstrated many of the benefits to be derived from investing in high-speed rail. The current express train trip time between Boston and New York City is approximately four hours. By improving the intercity trip times to less than 3 hours (the NECIP statutory goal), Amtrak can become the preferred intercity common carrier in the Boston to New York City market, much as it is presently the preferred intercity common carrier between New York City and Washington where trip times are approximately two hours and fifty minutes.

Reduced travel times and increased service reliability would increase the attractiveness of rail travel over alternate means with resulting transportation and environmental benefits. The potential diversion of automobile and air traffic could reduce vehicular traffic on major highways and surface roads, particularly those serving the region's major airports, and slow down the growth of air traffic, easing air traffic congestion. This would tend to delay the need for investments, and resulting environmental impacts, in these other modes of transportation.

A further benefit of the high-speed rail improvements will be significantly improved conventional service to the many smaller communities between New Haven and Boston. The improvements in intercity rail transportation would yield important regional and community air quality, energy efficiency, land use, and noise level benefits. Such improvements world be consistent with important Federal and state environmental objectives, including those specified in the 1991 Federal Clean Air Act Amendments (CAAA) mandating use of transportation technologies to improve air quality.

Based on the significant transportation and environmental benefits that would be derived from high-speed rail service between Boston and New York city, FRA eliminated the "do-nothing" alternative.

The proposed electrification system was found to be the best alternative available to achieve the benefits from improved intercity rail passenger service between Boston and New York City. When compared to the proven capabilities of existing, non-electric passenger rail equipment, the proven capabilities of advanced electric passenger trains obtain greater transportation and environmental benefits with minimal environmental impacts. It will generate greater ridership, consume less energy, and have a greater beneficial impact on air quality.

While there is promise in developing non-electric equipment that might achieve the capabilities of electric traction, such an effort faces technological and financial uncertainties. Even under the best of circumstances, it would take several years for a technology development program to run its course so that the capabilities of new equipment could be evaluated. During such a period, there would be a delay in realizing the substantial transportation and environmental benefits of improved intercity service which is an adverse environmental impact itself. And even optimistic views of the non-electric locomotive program do not suggest it will yield results significantly superior to the proven capabilities of electric traction. As a consequence, the extension of electric traction has been selected as FRA's preferred alternative.

With regard to electric traction, other design concepts were reviewed, but the design proposed is viewed as superior. It offers the necessary performance while minimizing possible impacts on adjacent communities and natural resources by limiting the number of utility tie-ins and substations required as well as mitigating the electromagnetic fields and interference that could result from such a system.

Site Alternatives

The siting of all of the 25 electric facilities that are part of this proposed project are interlinked. Among the factors that go into the siting of a particular facility are:

- projected train power demand, which relates to train size and weight as well as likely nature of train operations (speed, accelerating, or cruising, etc.) in the catenary segment served by that facility
- projected schedule and worst-case projections of the number of trains in the catenary section served by the facility
- voltage loss due to line resistance from the next facility
- safety margins to account for possible temporary loss of a facility

All of these factors and more feed into the complex analysis that leads to significant constraints on the flexibility of siting these facilities. Amtrak's design has a tolerance for the location of paralleling stations of +/- 1000 feet.

FRA has assessed the feasibility of locating the Kingston Paralleling Station outside the GSWMA; however, no feasible or prudent alternative site could be identified. The present design developed through numerous iterations that balanced the technical needs of the electric traction facility with attempts to minimize the impact of locating the fixed facilities on surrounding communities and natural resources.

The initial siting alternative assessed by FRA involved placing paralleling stations at either end of the GSWMA. Locating the site on the north end would be technically feasible; however, it would require either the relocation of a residence or filling of a wetland. On the southern side of the GSWMA, sites available for the paralleling station involved either filling of wetlands or locating the paralleling station too close to the Richmond Switching Station to serve as an effective voltage regulator. This in turn would require this latter site to be shifted to the west, and due to the interrelated nature of the electrical facilities, this would have a cascading effect on the 13 sites west of Richmond. Given the extreme difficulty encountered in locating available sites in this area, such a relocation would require trade-offs at more than one site between relocation of residences of businesses, or location of the facilities in wetlands, coastal flood plains, or other properties protected by Section 4(f). Based on this

analysis, it was determined that the two-paralleling station alternative would cause greater adverse impacts either on people or on the resources the GSWMA was designed to protect, and FRA concluded that this alternative was not prudent.

FRA then reviewed alternatives within the constraints of the location of this site. The available sites outside the GSWMA were located in a narrow area bounded on three sides by the GSWMA. These sites involved either relocation of a residence or fill of a wetland. As with the two-station option, it was determined that the one paralleling station option located outside the GSWMA would cause greater adverse impacts either on people or on the resources the GSWMA was designed to protect than location on a suitable site in the GSWMA. As a consequence, FRA concluded that this alternative too was not prudent.

PLANNING TO MINIMIZE HARM

Having concluded that there was no feasible and prudent alternative to location of the paralleling station in the GSWMA, FRA then began to identify the measures necessary to minimize any harm to the resources being protected in the GSWMA.

The first effort was to identify a location with the least impacts on the GSWMA. The site selected uses existing railroad right-of-way to the maximum extent possible and, hence, minimizes the amount of property needed from the GSWMA. The amount required, 0.10 acre, accounts for approximately 0.0003 percent of the total acreage in the GSWMA. This site, as shown in Figure G-2, is located in a narrow area between the existing NEC main line and the gravel road used to provide access into the GSWMA. The location is an upland site outside the buffer areas for any wetland and was selected in consultation with RIDEM to avoid an oak tree that provides wildlife cover, roosting spots, and nesting cavities.

The design of the facility incorporates measures to protect the ecology of the GSWMA and the local groundwater quality in the Pawcatuck Aquifer system. During construction, staging areas for construction equipment and supplies would be outside the GSWMA, and Best Management Practices would be employed to minimize the ground cover disturbed, limit disruption to local wildlife, protect the nearby oak tree, limit opportunities for erosion, and minimize the potential of spills from construction. RIDEM would have an opportunity to review and approve the final plans and monitor work as it progresses to ensure compliance with the plan.

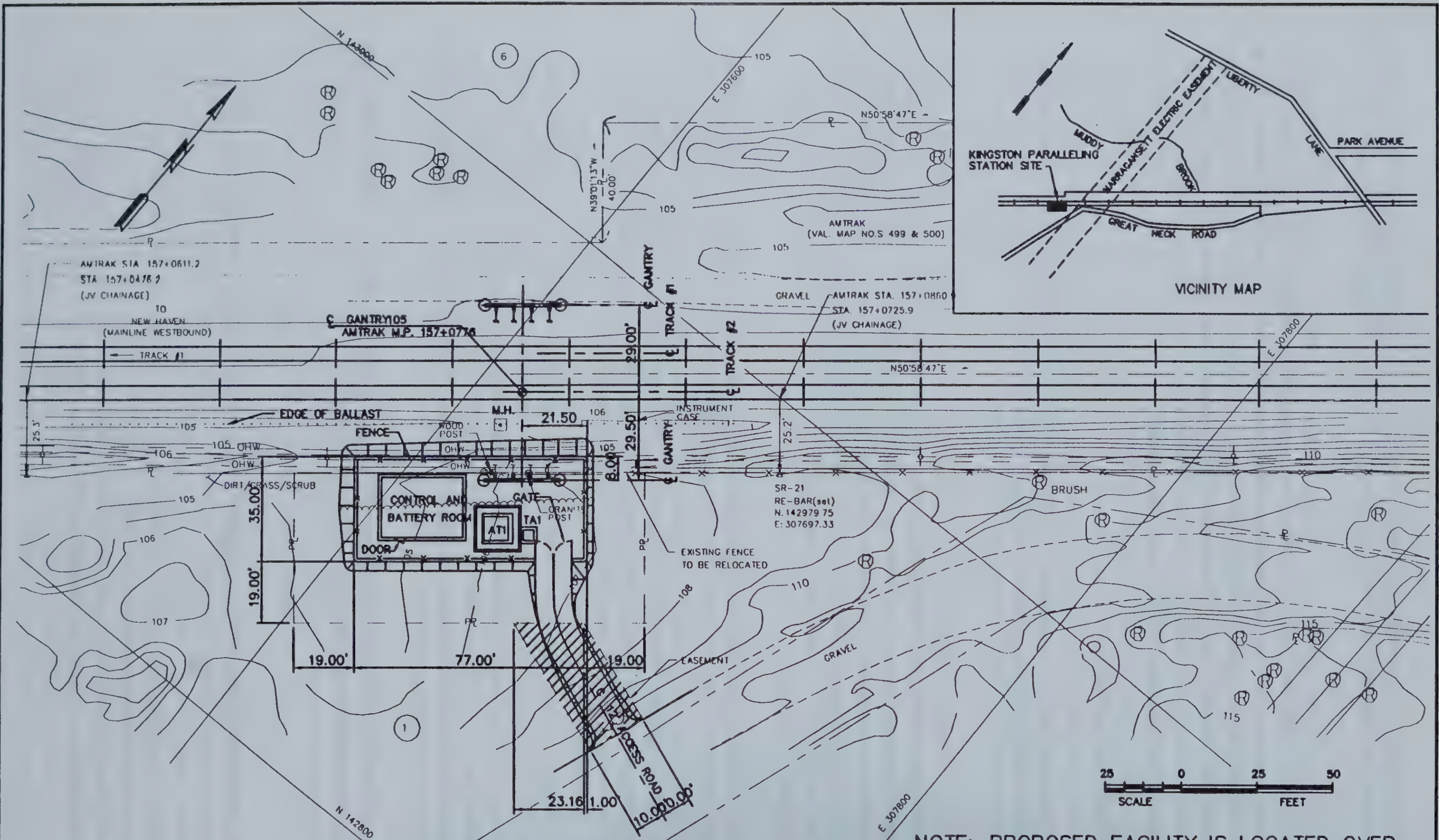
A system would be incorporated into the facility to contain any spills from the transformers and to warn Amtrak that a spill has occurred. The transformers would use only mineral oil as a coolant, so that if any spill does occur, it should be relatively benign. The site would be self-contained and need servicing only on an annual basis. As a consequence, there would not be a noticeable increase in human activity in the area. When completed, native shrub species selected by RIDEM would be planted around the proposed facility to screen it from the adjoining GSWMA and to act as cover for wildlife.

Finally, Amtrak would compensate the RIDEM for this property at fair-market value. This compensation would be used by RIDEM to acquire additional property to expand the GSWMA.

COORDINATION

Coordination with the appropriate regulatory agencies was maintained throughout this Section 4(f) evaluation. Agencies participating in the review include:

- RIDEM field office at the GSWMA
- RIDEM Planning and Administrative Services Office
- U.S. Department of the Interior Regional Office (Philadelphia, PA)
- U.S. Fish and Wildlife Service Offices (Providence, RI, Concord, NH, and Hadley, MA)



NOTE: PROPOSED FACILITY IS LOCATED OVER THE PAWCATUCK SOLE SOURCE AQUIFER AND IN THE GREAT SWAMP.

KINGSTON PARALLELING STATION M.P. 157.11

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure G-2

CONCLUSIONS

FRA has concluded, based upon its analysis of the design of the electrification project proposed by Amtrak, that no feasible or prudent alternative exists to the use of a portion of the Great Swamp Management Area for the Kingston Paralleling Station. Congress has concluded that development of high-speed rail service between Boston and New York City is in the regional and national interest. The electric traction system proposed is the best alternative to achieve the benefits of such service. A concomitant part of developing the electric traction system is developing facilities spaced at appropriate intervals adjacent to the rail line to regulate voltage in the overhead catenary system. And FRA could identify no feasible and prudent alternative to a site located in the GSWMA.

Having concluded that there was no feasible and prudent alternative to the use of a portion of the GSWMA, FRA has worked with the system designers and RIDEM to ensure that project design incorporates all possible planning to minimize harm to this wildlife refuge.

♦ APPENDIX H

List of Agencies, Organizations, and Persons Receiving the FEIS/R

APPENDIX H
LIST OF ORGANIZATIONS, AGENCIES AND PERSONS RECEIVING THE FEIS/R

NAME	REPRESENTING	CITY/STATE
RICHARD MCCORD	FEDERAL RAILROAD ADMINISTRATION, REGIONAL DIR.	CHICAGO, AL
JOHN C. POTTER C/O CEHND-ED-SY	U.S. ARMY CORPS OF ENGRS, HUNTSVILLE DIVISION	HUNTSVILLE, AL
HARRY T. PATON	FEDERAL RAILROAD ADMINISTRATION, REGIONAL DIR.	SACRAMENTO, CA
BRIAN J. SMITH	CALIFORNIA DEPT. OF TRANSPORTATION	SACRAMENTO, CA
JANIE PAGE BLANCHARD	BECHTEL CORPORATION	SAN FRANCISCO, CA
AYALEW ADAMO	CALIFORNIA DOT, DIVISION OF RAIL	SACRAMENTO, CA
R. R. RENO (CYR), M.B.A., P.E.	OFFICE OF THE AUDITOR GENERAL	ONTARIO, CAN
DICK CONANT	NAVY SUBBASE - ENVIRONMENTAL DEPT. BLDG 166	GROTON, CT
JOSEPH J. MCGEE	CONN. COMMISSIONER OF ECONOMIC DEVELOPMENT	ROCKY HILL, CT
RONALD ROZSA	CONN. DEP, OFFICE OF LONG ISLAND SOUND PROGRAM	HARTFORD, CT
DONALD CASSIN	CONN. DEPARTMENT OF PUBLIC WORKS	HARTFORD, CT
DAVID PORIER	CONN. HISTORICAL COMMISSION	HARTFORD, CT
STANLEY V. GREIMANN	CONN. RIVER ESTUARY REGINAL PLANNING AGENCY	OLD SAYBROOK, CT
DORIS SANSTROM	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	WESTBROOK, CT
ELAINE WELLS	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	OLD LYME, CT
ELSA PAYNE	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	OLD SAYBROOK, CT
HARRIET NAUGHTON	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	OLD SAYBROOK, CT
JANE MARSH	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	DEEP RIVER, CT
KENNETH KELLS	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	IVORYTON, CT
PATRICIA SMULDERS	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	KILLINGWORTH, CT
SANDRA HUBER	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	ESSEX, CT
VIRGINIA ZAWOY	CONN. RIVER ESTUARY REGIONAL PLANNING AGENCY	CLINTON, CT
IRWIN WILCOX, CHAIRMAN	CONN. RIVER GATEWAY COMMISSION	OLD SAY BROOK, CT
DON DOHERTY	CONNDOT	PORTLAND, CT
RICHARD L. LEETE	CONNDOT - ASSISTANT DIRECTOR OF RAIL	NEWINGTON, CT
EMIL H. FRANKEL	CONNDOT - COMMISSIONER	NEWINGTON, CT
MICHAEL SAUNDERS	CONNDOT - DEPUTY COMM. FOR POLICY/PLANNING	NEWINGTON, CT
PETER ZABEL	CONNDOT - DEPUTY COMM., PLANNING	NEWINGTON, CT
PATRICIA ZEDALIS.	CONNDOT - DEPUTY COMM./PUBLIC TRANSPORTATION	NEWINGTON, CT
EARL R. MUNROE	CONNDOT - DIRECTOR OF ENGINEER	NEWINGTON, CT
RAY GODCHER	CONNDOT - SUPERVISOR OF PLANNING	NEWINGTON, CT
RICHARD RATHBUN	CONNDOTrLF - DIRECTOR OF RAIL OPERATIONS	NEWINGTON, CT
TIMOTHY R. E. KEENEY, COMM.	CONNECTICUT DEPT OF ENVIRONMENTAL PROTECTION	HARTFORD, CT
JOEL RINEBOLD	CONNECTICUT SITING COUNCIL, EXECUTIVE DIRECTOR	NEW BRITAIN, CT
THOMAS OUELLETTE	DEP - LONG ISLAND SOUND PROG.	HARTFORD, CT
RICHARD CLIFFORD, BUREAU CHIEF	DEP - BRANCH OF ENVIRONMENTAL CONSERVATION	HARTFORD, CT
FREDERICK REISE	ENVIRONMENTAL REVIEW - CONN. DEPT. OF ENV.	HARTFORD, CT
THOMAS H. BRILLAT	RHODE ISLAND PORT AUTHORITY	N. KINGSTON, CT
RICHARD B. ERICKSON, DIRECTOR	SE CONNECTICUT COUNCIL OF GOVERNMENTS	NORWICH, CT
JOHN P. HUDAK, SR. ANALYST	SOUTH CENTRAL CT REGIONAL WATER AUTHORITY	NEW HAVEN, CT
TOM CHAPILK	SOUTH CENTRAL CT REGIONAL WATER AUTHORITY	NEW HAVEN, CT
HERB BURSTEIN	SOUTH CENTRAL REGIONAL COUNCIL OF GOVERNMENTS	NEW HAVEN, CT
NICHOLAS N. COLONESE	STATE BOARD OF HARBOR COMMISSIONERS	NEW HAVEN, CT
MIKE ROSENKRANTZ	ASSISTANT TOWN MANAGER	GROTON, CT
LEROY V. STROHLA	CHAIRMAN OF THE OLD LYME PLANNING COMMISSION	OLD LYME, CT
BRAE RAFFERTY	CHAIRMAN OF THE TOWN OF GROTON CONSERVATION	GROTON, CT

NAME	REPRESENTING	CITY/STATE
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LEONARD LISS	DEPT. OF TRAFFIC & PARKING	NEW HAVEN, CT
SALLY ESPOSITO	DISABILITY SERVICES, CITY OF NEW HAVEN	NEW HAVEN, CT
MARGARETT J. PHILBRICK	NASHANTUCKET LAND TRUST - V. P.	STONINGTON, CT
BRUCE HYDE	OFFICE OF DEV. AND PLANNING - NEW LONDON, CT	NEW LONDON, CT
THOMAS V. WAGNER	PLANNING DIRECTOR - WATERFORD, CT	WATERFORD, CT
CRAIG FLOYD, POSTMASTER	POST MASTER	WEST MYSTIC, CT
RALPH KLINGDEIL	SHELLFISH COMMISSION	STONINGTON, CT
BRUCE C. BEEBE	SHELLFISH COMMISSION - MADISON, CT	MADISON, CT
MR. RICHARD C. CARPENTER	SOUTH WESTERN REGIONAL PLANNING AGENCY, EX.	EAST NORWALK, CT
HONORABLE BARBARA KENNELLY	U.S. HOUSE OF REP. - DIST. 1 (CT)	HARTFORD, CT
HONORABLE SAM GEJDENSON	U.S. HOUSE OF REP. - DIST. 2 (CT)	NORWICH, CT
HONORABLE ROSA DELAURO	U.S. HOUSE OF REP. - DIST. 3 (CT)	NEW HAVEN, CT
HONORABLE CHRISTOPHER SHAYS	U.S. HOUSE OF REP. - DIST. 4 (CT)	STAMFORD, CT
HONORABLE GARY A. FRANKS	U.S. HOUSE OF REP. - DIST. 5 (CT)	WATERBURY, CT
HONORABLE NANCY L. JOHNSON	U.S. HOUSE OF REP. - DIST. 6 (CT)	NEW BRITAIN, CT
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SENATOR JOSEPH LIEBERMAN	U.S. SENATE	HARTFORD, CT
NAOMI OTTERNESS, DIST. DIR.	CONGRESSMAN GEJDENSON'S OFFICE	NORWICH, CT
GOVERNOR LOWELL P. WEIKER, JR.	CONNECTICUT STATE HOUSE	HARTFORD, CT
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REP. GARY OREFICE	CT GENERAL ASSEMBLY - DIST. 37	NIANTIC, CT
REP. ANDREA L. STILLMAN	CT GENERAL ASSEMBLY - DIST. 38	WATERFORD, CT
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REP. LENNY T. WINKLER	CT GENERAL ASSEMBLY - DIST. 41	GROTON, CT
REP. MARY K. MCGRATTAN	CT GENERAL ASSEMBLY - DIST. 42	GALES FERRY, CT
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REP. ROBERT M. WARD	CT GENERAL ASSEMBLY - DIST. 86	NORTHFORD, CT
REP. NANCY BEALS	CT GENERAL ASSEMBLY - DIST. 88	HAMDEN, CT
REP. PARTICIA A. DILLON	CT GENERAL ASSEMBLY - DIST. 92	NEW HAVEN, CT
REP. HOWARD C. SCIPIO	CT GENERAL ASSEMBLY - DIST. 93	NEW HAVEN, CT
REP. WILLIAM R. DYSON	CT GENERAL ASSEMBLY - DIST. 94	NEW HAVEN, CT
REP. ANDREA JACKSON-BROOKS	CT GENERAL ASSEMBLY - DIST. 95	NEW HAVEN, CT
REP. CAMERON C. STAPLES	CT GENERAL ASSEMBLY - DIST. 96	NEW HAVEN, CT
REP. CHRIS DEPINO	CT GENERAL ASSEMBLY - DIST. 97	NEW HAVEN, CT
REP. JANET C. POSS	CT GENERAL ASSEMBLY - DIST. 98	GUILFORD, CT
REP. MICHAEL P. LAWLOR	CT GENERAL ASSEMBLY - DIST. 99	EAST HAVEN, CT
HONORABLE FRED LUNDFELT	CT STATE REPRESENTATIVE	NIANTIC, CT
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SENATOR MARTIN M. LOONEY	CT STATE SENATE - DIST. 11	NEW HAVEN, CT
SENATOR WILLIAM A ANISKOVICH	CT STATE SENATE - DIST. 12	BRANFORD, CT
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SENATOR MELODIE PETERS	CT STATE SENATE - DIST. 20	QUAKER HILL, CT
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ED STUART	DIRECTOR OF PUBLIC WORKS	WATERFORD, CT
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ED ECKELMEYER	GROTON, CT TOWN COUNCIL	NOANK, CT
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PHILLIP BOLDUC - ZONING DIR.	NEW HAVEN, CT	NEW HAVEN, CT
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CAPT. WILLIAM DITTMAN	NEW LONDON POLICE DEPARTMENT	NEW LONDON, CT
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ANTHONY PANICO	TOWN CONSULTANT, PLANNING	EAST HAVEN, CT
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SHIRLEY RASMUSSEN	TOWN PLANNER - BRANFORD, CT	BRANFORD, CT
JAMES S. BUTLER	TOWN PLANNER - GROTON, CT	GROTON, CT
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ROBERT PETERSON	WESTBROOK CONSERVATION COMMISSION	WESTBROOK, CT
WILLIAM McMINN	ZONING ADMINISTRATOR	MADISON, CT
BARBARA B. SWAN	ZONING ENFORCEMENT	CLINTON, CT
VINCENT J. FAULISE		PAWCATUCK, CT
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STEPHEN P. JONES	C/O SYLVINA W. BEAL CRUISES	WEST MYSTIC, CT
LOUIS SCHIME	CACCE c/o CONN BUSINESS & INDUSTRY ASSOCIATION	HARTFORD, CT
JASON C. BECKER, PRESIDENT	CITIZENS AGAINST THE AMTRAK ELECTRIFICATION	STONINGTON, CT
ROBERT BURGESS	CONN ASSOC FOR COMMUNITY ACTION	MERIDEN, CT
JIM ULLMAN	CONN ASSOC OF RAIL AND BUS USERS	MERIDEN, CT
MARVIN B. MORGANBESSER	CONN. CONSTRUCTION INDUSTRIES ASSOC, INC.	WETHERSFIELD, CT

NAME	REPRESENTING	CITY/STATE
ARTHUR LARSON	CONN. LIGHT & POWER	GUILFORD, CT
PETER KENEFICK	CONN. LIGHT & POWER	OLD SAYBROOK, CT
PAUL KERBER, JR.	CONN. RAILROAD HISTORICAL ASSOC., INC.	CANAAN, CT
LELAND BERHAM	CONN. TRUST FOR HISTORIC PRESERVATION	HAMDEM, CT
ELIZABETH MCLAUGHLIN	CONNECTICUT AUDUBON SOCIETY	HARTFORD, CT
ROBERT B. BRAUN	CONNECTICUT AUDUBON SOCIETY	FAIRFIELD, CT
W.B. SHEFFIELD	CONNECTICUT ELECTRIC RAIL ASSOCIATION	EAST WINDSOR, CT
BOB RUMBEL	CONNECTICUT LIGHT AND POWER (CL+P)	NEW LONDON, CT
PETER A. FOOTE, DIRECTOR	CONNECTICUT MARINE TRADES ASSOCIATION, INC.	ESSEX, CT
RALPH GRIFAN	CONNECTICUT RIVER STRIPED BASS CLUB	OLD LYME, CT
CRAIG PATLA	CONNECTICUT WATER COMPANY	CLINTON, CT
DONALD S. STRAIT	CONNECTITUT FUND FOR THE ENVIRONMENT	HARTFORD, CT
JOSEPH V. MEANEY, JR.	CRANMORE FITZGERALD & MEANEY	HARTFORD, CT
STAN GREIMANN	CRERPA	OLD SAYBROOK, CT
DAVID W. CROCKER	CROCKER'S BOATYARD, INC.	NEW LONDON, CT
JOEL COGEN	CT CONFERENCE OF MUNICIPALITIES	NEW HAVEN, CT
ERNEST M. JULIAN	CT ENVIRONMENTAL HEALTH ASSOC	HARTFORD, CT
JANET GAINES	CT LEAGUE OF HISTORICAL SOCIETIES	BRANFORD, CT
DOUGLAS J. VAN DYKE	DEEP RIVER MARINA, INC.	DEEP RIVER, CT
GEORGE SYLVESTER	DIRECTOR OF ADM. SERVICES	STONINGTON, CT
MAURICE WOODWORTH	DTC	MADISON, CT
JONATHAN DUNCKLEE, VP	DUNCKLEE, INC.	MYSTIC, CT
FRANK N. EPPINGER	ELIHU ISLAND TRUST	GROTON, CT
PETER G. FREEMAN	ELIHU ISLAND TRUST	STONINGTON, CT
WALTER L. SCHIEFERDECKER	ESSEX ISLAND MARINA, INC.	ESSEX, CT
KENNETH A. MACGREGOR	FITZGERALD & HALLIDAY, INC.	HARTFORD, CT
DOUGLAS HERSANT	FORT RACHEL MARINA	MYSTIC, CT
DOUGLAS J. HERSANT	FORT RACHEL MARINE SERVICE, INC.	MYSTIC, CT
JOHN DUHIG	FORTUNE PLASTIC, INC.	OLD SAYBROOK, CT
JAMES LEWIS	GALES FERRY MARINA, INC.	GALES FERRY, CT
MRS. MERLE HORNSTEIN	GUILFORD KEEPING SOCIETY	GUILFORD, CT
ALIX BIEL	HARTFORD COURANT	OLD SAYBROOK, CT
SAM LIBBY	HARTFORD COURANT	OLD SAYBROOK, CT
WILLIAM KEVENEY, TRANSP. ED.	HARTFORD COURANT	HARTFORD, CT
VINCENT J. PETRELLA	HELLIER YACHT SALES, INC.	NEW LONDON, CT
RICHARD RUZZO	HENDEL'S PETROLEUM	WATERFORD, CT
MR. RAND JIMMERSON	HISTORIC MANUSCRIPTS AND ARCHIVES	STORRS, CT
WAYNE L. BURDICK, DIRECTOR	JEANNEAU, NORTH AMERICA	NEW LONDON, CT
JOHN O'CALLAHAN	JOCR RESEARCH	STONINGTON, CT
PETE JONES	LEAGUE OF WOMEN VOTERS	GROTON, CT
MARY JANE ENGLE, MPH	LEDGE LIGHT HEALTH DISTRICT	GROTON, CT
CHRIS TEMPLE	LEDYARD HIGH SCHOOL GOVT.	GALES FERRY, CT
ERIC BREWER	LEDYARD HIGH SCHOOL GOVT.	LEDYARD, CT
WADE STEPHENSON	LEDYARD HIGH SCHOOL GOVT.	GALES FERRY, CT
ROBERT H. DUNLOP, PRES.	MADISON RACQUET CLUB	MADISON, CT
GEORGE MARCUS, PE	MARCUS ASSOCIATES, INC.	NOANK, CT
THOMAS F. MITCHELL	MARINPRO	STONINGTON, CT
POPI ANTARANIS	METCALF & EDDY, INC.	MERIDEN, CT
DAVID PITCH	MIDDLETOWN PRESS	MIDDLETOWN, CT
MS. ALICE WAUGH	MIDDLETOWN PRESS	OLD SAYBROOK, CT
PAMELA DAWKINS	MIDDLETOWN PRESS	MIDDLETOWN, CT
MICHAEL E. SCAVOTTO	MYSTIC CHAMBER OF COMMERCE	MYSTIC, CT

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ELAINE C. PERRY	MYSTIC MARINE BASIN	STONINGTON, CT
JANICE INMAN	MYSTIC MARINE BASIN	STONINGTON, CT
PETER AUSTER	MYSTIC RIVER WATERSHED	LEDYARD, CT
FRANKLIN KNEEDLER	MYSTIC SEAPORT MUSEUM	OLD MYSTIC, CT
CARL GEHRING	MYSTIC SHIPYARD INC.	WEST MYSTIC, CT
DAVE ALTIMARI	NEW HAVEN REGISTER	MADISON, CT
STAN FISHER	NEW HAVEN REGISTER	OLD SAYBROOK, CT
ANTHONY MOURA	NEW HAVEN REGISTER - TRANSPORTATION EDITOR	NEW HAVEN, CT
CHRISTINE WOODSIDE	NEW LONDAY DAY	NEW LONDON, CT
KEITH PHANEUF	NEW LONDON DAY	NEW LONDON, CT
KYN TOLSON	NEW LONDON DAY	NEW LONDON, CT
MAURA CASEY	NEW LONDON DAY - ASSOC. EDITORIAL EDITOR	NEW LONDON, CT
MARY C. ANDERSON, PRESIDENT	NOANK HISTORICAL SOCIETY, INC.	NOANK, CT
WILLIAM ELLIS, CEO	NORTHEAST UTILITIES	BERLIN, CT
WILLIAM M. LEAHY	NORTHEAST UTILITIES SYSTEM	BERLIN, CT
JOHN C. O'BRIEN	O'BRIEN SHAFNER STUART KELLY & MORRIS	GROTON, CT
DAVID MAZZALUPO	OAK RIDGE FOREST CORPORATION	OLD LYME, CT
RICHARD AND ELIZABETH SAGAN	OLD LYME FEDERATION OF BEACHES	OLD LYME, CT
EVAN GRIZWOLD	OLD LYME LAND TRUST	OLD LYME, CT
JOYCE OLSON RESNIKOFF	OLDE MYSTIC VILLAGE	MYSTIC, CT
DAVID WARNER	PASSENGER TRAIN JOURNAL	NEW LONDON, CT
JAY POPIELARRYK	PEPCO	BRISTOL, CT
LEE MICHAUD	PEPCO	BRISTOL, CT
RENE GAUTHER	PLANVILLE ELECTRIC PRODUCT CO.	BRISTOL, CT
RONALD P. CHRYANOWSKI	PROVIDENCE & WORCESTER RAILROAD	N GROSVENOR DALE, CT
HANK CHARLES	PROVIDENCE & WORCESTER RAILROAD CO.	DANIELSON, CT
G. ANT	SCRPA	NORWICH, CT
PETER & ANN FREEMAN	SOUTH ISLAND TRUSTEE	STONINGTON, CT
STEPHEN J. JONCUS	STEPHEN J. JONCUS AIA, ARCHITECT	OLD LYME, CT
GEOFFREY P. JONES	SYLVINA W. BEAL CRUISES	WEST MYSTIC, CT
KENNETH MULL	TEXTRON LYCOMIG	STRATFORD, CT
KENNETH W. KELLS	THE CONNECTICUT WATER COMPANY	CLINTON, CT
MARIA HIALMEN	THE NEW LONDON DAY	NEW LONDON, CT
CHRISTOPHER PERCY	THE SOUND CONSERVANCY	ESSEX, CT
ALBERT F. PAOLINI, CEO	TILCON CONNECTICUT, INC.	NORTH BRANFORD, CT
ROBERT WALTON	TRACOR INC.	NEW LONDON, CT
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JOHN BROOKS, LCDR	US COAST GUARD	WEST MYSTIC, CT
WILLIAM F. FILBERG	VALLEY RAILROAD	WESTBROOK, CT
WILLIAM FUHEY	VALLEY RAILROAD	WESTBROOK, CT
OLIVER JENSEN	VALLEY RAILROAD COMPANY	OLD SAYBROOK, CT
ERNEST RICHARDSON	WALKER'S DOCK	BOLTON, CT
HERBERT R. SHROYER	WALKER'S DOCK	MANCHERSTER, CT
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A. E. NOEL		GROTON LONG PT, CT
ALAN P. AND ANNE H. BENTZ		STONINGTON, CT
ALICE STORROW		STONINGTON, CT
ALLAN H. SMITH		MYSTIC, CT
AMY G. COCHRAN		STONINGTON, CT
AMY L. HAINLINE		WEST MYSTIC, CT

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ANN C. BARDWELL		N. STONINGTON, CT
ANN CROTTY		GROTON, CT
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ANNE DUHAINE		GUILFORD, CT
ARNOLD W. AVERY		NOANK, CT
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BARBARA WILLIAMS		NOANK, CT
BEATRICE E. MINSON		OLD LYME, CT
BEN THOMSON		OLD LYME, CT
BERYL DOMINY		NOANK, CT
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BETTY RICHARDS		STONINGTON, CT
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BILL MURRAY		BRANFORD, CT
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BOB FRINK		NOANK, CT
BRIAN SWAIN		STONINGTON, CT
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CAROL McDERMOTT		WEST MYSTIC, CT
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CAROLYN MARTUS		STONINGTON, CT
CARROLL A. BAYUTON		STONINGTON, CT
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CDR CALVIN .E CROUCH		NOANK, CT
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CHRIS ROSE		STONINGTON, CT
CHRIS SCRANTON		MADISON, CT
CHRISTINE DANOFF		GROTON, CT
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CLAUDIA GOODRIDGE		GUILFORD, CT
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ERNEST WHITMAN		GROTON, CT
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FRANCIS J. WILLIAMS		NOANK, CT
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GAIL TYLER		BLOOMFIELD, CT
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GARY DOOLEY		HAMDEN, CT
GARY SCHULTE		STONINGTON, CT

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JAMES D. BUCKLEY		MYSTIC, CT
JAMES F. RANCO		CLINTON, CT
JAMES J. MUSANTE		GROTON, CT
JAMES MUSANTE		GROTON, CT
JAMES McE. BROWN		STONINGTON, CT
JAMES W. CAHILL		OLD SAYBROOK, CT
JAN LEHRMAN		WEST MYSTIC, CT
JANE AND JOE BURT		OLD LYME, CT
JANE KNOP		MADISON, CT
JANE SCHOONORER		STONINGTON, CT
JANET LAGE		OLD LYME, CT
JANIS TERWILLIGER		EAST HAMPTON, CT
JAY E. MADDEN		PAWCATUCK, CT
JEAN P. CASTAGNO		OLD SAYBROOK, CT
JEAN SIMPSON		MYSTIC, CT
JEANNE RUTIGLIANO		LYME, CT
JEFFREY S. BURKE		HANDEN, CT
JERRY L. FOOTE		MYSTIC, CT
JESSICA MORRISSEY BREEN		STONINGTON, CT
JIM COWELL		OLD SAYBROOK, CT
JIM RICE		OLD LYME, CT
JOANNE T. BALDWIN		STONINGTON, CT
JOE BERTOLINE		PAWCATUCK, CT
JOE ORTS		MADISON, CT
JOEL MAYNARD		WESTBROOKN, CT
JOHN & AMY HAINLINE		WEST MYSTIC, CT
JOHN A. MALCARNE		DEEP RIVER, CT
JOHN ALLEN		STONINGTON, CT
JOHN D. EATON		NOANK, CT
JOHN DURBOROW		STONINGTON, CT
JOHN E. KING		MYSTIC, CT
JOHN H. ROY JR.		GROTON, CT
JOHN T. GODSMARK		CLINTON, CT
JOHN UMLAND		GROTON, CT
JOHN WALTON		OLD MYSTIC, CT
JONATHAN P. GRACE		HAMDEN, CT
JONATHON GIBSON		PAWCATUCK, CT
JOSEPH BERTOLINE		PAWCATUCK, CT
JOSEPH E. GEARY		STONINGTON, CT

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JUDITH AND ROBERT ROBINSON		MADISON, CT
JUDITH W. NEUARTH		STONINGTON, CT
JUDITH W. NEURATH		STONINGTON, CT
K.M. DARLING		MADISON, CT
KAREN ANDERSON		MYSTIC, CT
KAREN LEWIS		STONINGTON, CT
KAREN M. NICHOLLS		MADISON, CT
KATE MEANEY		OLD LYME, CT
KATHARINE H. ROBINSON		WEST HARTFORD, CT
KATHERINE JOHNSTONE		STONINGTON (BORO), CT
KELLEY HOUSE		NOANK, CT
KENNETH MACGREGOR		ENFIELD, CT
L'ANA AND JOHN BURTON		NOANK, CT
LAURA M. ROBBINS		STONINGTON, CT
LAURINDA BARRETT		NEW YORK, CT
LEIGHTON B. CARLSON		MADISON, CT
LINDA REYNOLDS		EAST HAMPTON, CT
LINDA VOGEL, Ph.D.		MYSTIC, CT
LOIS E. MAURO		MADISON, CT
LOUDON FAIRGRIEVE		MYSTIC, CT
LOUISA SHAKKOUR		NEW LONDON, CT
M. BRUCE REIBER		MADISON, CT
M. PATRICIA WALTERS		OLD LYME, CT
MARCIA W. PORTER		STONINGTON, CT
MARGARET C. OLIVER		STONINGTON, CT
MARGE & JACK MACNEIL		BRANFORD, CT
MARIA SCHMIDT		MADISON, CT
MARIA T. KSEIZOPOLSKA		STONINGTON, CT
MARIA WILEY		NOANK, CT
MARIE TYLER WILEY		NOANK, CT
MARK J. VINETTE		NOANK, CT
MARY BROWNING		OLD LYME, CT
MATTHEW J. AANNAN		MYSTIC, CT
MAUREEN A. WELSH.		OLD LYME, CT
MELANIE GREENHOUSE		NOANK, CT
MELISSA HYLAND		NOANK, CT
MICHAEL AMATRUDO		MADISON, CT
MICHAEL BLAIR		STONINGTON, CT
MICHAEL D. PRIOR		GUILFORD, CT
MICHAEL JAMES		NEW LONDON, CT
MICHAEL W. CYR		CLINTON, CT
MIKE PRIOR		GUILFORD, CT
MR & MRS ARNOLD		PAWCATUCK, CT
MR. & MRS. J. AMATUCCI		NIANTIC, CT
MR. & MRS. J. WILLIAM CUTTING		BRANFORD, CT
MR. & MRS. MICHAEL DIORIO		WEST MYSTIC, CT
MRS ALUZEHCEDER		STONINGTON, CT
NANCY H. WARBURTON		STONINGTON, CT
NANCY J. KNOWLES		STONINGTON, CT
NEILD B. OLDHAM		NEW LONDON, CT
PAM CANNON		WEST MYSTIC, CT
PAT GEARY		STONINGTON, CT

NAME	REPRESENTING	CITY/STATE
PATRICIA A. O'LEARY		OLD LYME, CT
PATRICIA S. BULLIS		STONINGTON, CT
PATRICK CROWLEY		NEW LONDON, CT
PATRICK J. CARLIN		MYSTIC, CT
PAUL BATES		NOANK, CT
PETE KENEDRICK		OLD SAYBROOK, CT
PETER BEACH		BRANFORD, CT
PETER E. LYNCH		OLD SAYBROOK, CT
PETER FREDERICKSON		OLD SAYBROOK, CT
R. A. PETERSON		WESTBROOK, CT
R. BLAKE		MADISON, CT
R. H. DICKSON, JR.		NOANK, CT
R.B. CUMMINGS		STONY CREEK, CT
R.B. REFEY		MYSTIC, CT
R.W. EGGLETON		WATERFORD, CT
RALPH F. SPARACO		WESTBROOK, CT
RALPH SPURACO		WESTBROOK, CT
RANDY GREENE		SALEM, CT
RAYMOND BELVAL		GALES FERRY, CT
REGINA COVIN		NOANK, CT
REGIS FERGUSON		STONINGTON, CT
RICHARD & DOROTHY NORTH		NIANTIC, CT
RICHARD D. HAVILAND		GROTON, CT
RICHARD G. WIBEN, JR		NOANK, CT
RICHARD S. EATON		GUILFORD, CT
RICK DICKSON		NOANK, CT
RILLIAM VICTORIA		STONINGTON, CT
RITA OLDEWAY		NOANK, CT
ROBERT A. GAYER		GROTON, CT
ROBERT DICESARE		PAWCATUCK, CT
ROBERT FROMER		NEW LONDON, CT
ROBERT GERARD		MADISON, CT
ROBERT I. WELSH, JR.		WATERFORD, CT
ROBERT L. LILLIQUEST		BRANFORD, CT
ROBERT P. WALTON		NORWICH, CT
ROBERT SCHNEIDER		NOANK, CT
ROBERT SCHNEIDER		NOANK, CT
ROBIN R. SMITH		MYSTIC, CT
ROGER H. DICKINSON		STONINGTON, CT
ROGER LeMONTANQUE		MADISON, CT
ROGER RYLEY		MYSTIC, CT
RON LEWIS		STONINGTON, CT
RONALD SULLIVAN		OLD SAYBROOK, CT
ROWLAND HUNT		KILINGWORTH, CT
SCOTT GARDINER		WATERFORD, CT
SHARON SULLIVAN-BALL		STONINGTON, CT
SHERRY HOUSE		NOANK, CT
SHERWIN GOGGIN		STONINGTON, CT
SHERWIN GOGGIN		STONINGTON, CT
SHIRLEY C. BEAL		STONINGTON, CT
SHIRLEY CHACHO		GUILFORD, CT
SIDNEY GROSS		MYSTIC, CT

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STEPHEN A. FLIS		OLD LYME, CT
STEPHEN B. SPEAR		OLD LYME, CT
STEPHEN T. BROWN		MYSTIC, CT
STEVE PARKER		NORTHFORD, CT
STEVEN SPELLMAL		PAWCATUCK, CT
STEVEN SPELLMAN		PAWCATUCK, CT
STUART G. COLE		STONINGTON, CT
STUART M. LOW		GUILFORD, CT
SUSAN H. MUNGER		NEW LONDON, CT
SUSAN RONOHAGAN		MADISON, CT
SUZANNE CATTANACH		NEW LONDON, CT
T. H. MCGLASHAN		STONY CREEK, CT
TANA RAIKES		NOANK, CT
TED RICE		MYSTIC, CT
TERRY MCBRIEN		PORTLAND, CT
TERRY PAEVELER		NEW LONDON, CT
THOMAS CEDDIN, MD		MYSTIC, CT
THOMAS E. HASSENMAYER		NEW HAVEN, CT
THOMAS LAW		PAWCATUCK, CT
THOMAS TYLER		WEST HARTFORD, CT
TIM ABBOTT		IVORYTON, CT
TIMOTHY S. BAILEY		WATERFORD, CT
TOM CEDDIA		MYUSTIC, CT
TOM JECAGE		MADISON, CT
TOM MURPHY		MADISON, CT
TOM MacDONALD		MADISON, CT
TRACY H. SMITH		WATERFORD, CT
W. WALLACE FENN		NOANK, CT
W.A. KLINGER		OLD SAYBROOK, CT
WICK AND RODI YORK		STONINGTON, CT
WILL L. SCRANTON		MADISON, CT
WILLIAM & SHARON TEIXEIRA		STONINGTON, CT
WILLIAM A. NIERING		NEW LONDON, CT
WILLIAM A. VICTORIA		STONINGTON, CT
WILLIAM E. LOCKWOOD		STONINGTON, CT
WILLIAM H. FUHIER		GUILFORD, CT
WILLIAM K. DUFF		STONINGTON, CT
WILLIAM KETTERER III		MADISON, CT
WILLIAM LEAHY		KILLINGWORTH, CT
WILLIAM M. CANNON		WEST MYSTIC, CT
WILLIAM PUTSIS		CLINTON, CT
WILLIAM T. LASKY		OLD SAYBROOK, CT
WILLIAM TEIXEIRA, JR.		STONINGTON, CT
WILLIAM W. BELL		STONINGTON, CT
WINNIE COLEMAN		MYSTIC, CT
YVETTE GOULET FUKA		WATERFORD, CT
ZACK JOHNSON		MYSTIC, CT
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DIRECTOR	E.S.SCRANTON MEMORIAL LIBRARY	MADISON, CT
DIRECTOR	EAST LYME PUBLIC LIBRARY	EAST LYME, CT
DIRECTOR	FAIR HAVEN BRANCH LIBRARY	NEW HAVEN, CT
DIRECTOR	GROTON PUBLIC LIBRARY	GROTON, CT

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DIRECTOR	HAGAMAN MEMORIAL LIBRARY	EAST HAVEN, CT
DIRECTOR	HENRY CARTER HALL LIBRARY	CLINTON, CT
DIRECTOR	JAMES BLACKSTONE MEM, LIBRARY	BRANFORD, CT
DIRECTOR	LYME PUBLIC LIBRARY	OLD LYME, CT
DIRECTOR	MITCHELL BRANCH LIBRARY	NEW HAVEN, CT
DIRECTOR	NEW HAVEN FREE PUBLIC LIBRARY	NEW HAVEN, CT
DIRECTOR	OLD LYME PUBLIC LIBRARY	OLD LYME, CT
DIRECTOR	PUBLIC LIBRARY OF NEW LONDON	NEW LONDON, CT
DIRECTOR	STETSON BRANCH LIBRARY	NEW HAVEN, CT
DIRECTOR	STONINGTON FREE LIBRARY ASSOC.	STONINGTON, CT
DIRECTOR	WATERFORD PUBLIC LIBRARY	WATERFORD, CT
DIRECTOR	WESTBROOK PUBLIC LIBRARY	WESTBROOK, CT
DIRECTOR	WILLOUGHBY WALLACE MEM. LIBRARY	BRANFORD, CT
BRUCE CLOUETTE	HISTORIC RESOURCE CONSULTANTS	HARTFORD, CT
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JAMES HAGEN, PRESIDENT	CONRAIL	WASHINGTON, DC
ELAINE KAISER, CHIEF	INTERSTATE COMMERCE COMM., SECTION OF	WASHINGTON, DC
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LAURIE LEDGARD	STATES NEWS SERVICE	WASHINGTON, DC
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BARBARA MCDONOUGH		ROSLINDALE, MA
BERNARD DOHERTY		JAMAICA PLAIN, MA
BETSY MONAHAN		JAMAICA PLAIN, MA
BETTY JO GREEN		JAMAICA PLAIN, MA
BEVERLY ESTES-SMARGIASSI		JAMAICA PLAIN, MA
BEVERLY SHALOM		JAMAICA PLAIN, MA
CARL HANSON		BEDFORD, MA
CARLOS DIAZ		JAMAICA PLAIN, MA
CINTHIA D. PAPE		JAMAICA PLAIN, MA
CLYDE CORTRIGHT		HYDE PARK, MA
CYNTHIA PAPE		JAMAICA PLAIN, MA
DAVE KANTOR		SHARON, MA
DAVID DWYER		PEABODY, MA
DAVID MARTINEZ		ROSLINDALE, MA
DEBORAH GALIGA		JAMAICA PLAIN, MA
DELIA REDDICK		ROSLINDALE, MA
DENISE MONKS		JAMAICA PLAIN, MA
DIANE MCCARTHY		HYDE PARK, MA
EDDIE ORTEGA		JAMAICA PLAIN, MA
EMERY J. COLLINS II		BOSTON, MA
FRANK LAPRISE		WEST ROXBURY, MA
GEOFFREY H. LEAKE		JAMAICA PLAIN, MA
GEOFFREY LEAKE		JAMAICA PLAIN, MA
GEORGE C. HARDIMAN		CANTON, MA
HELEN GAVIN		KINGSTON, MA
HELEN ZEILLER		BRANFORD CT, MA
HOWARD P. BROWN JR.		ATTLEBORO, MA
JAMES GREENE		JAMAICA PLAIN, MA
JAMES KILGORE		JAMAICA PLAIN, MA
JAMES LESNICK		JAMAICA PLAIN, MA
JAMES LESNICK		JAMAICA PLAIN, MA
JEAN H. POWERS		HYDE PARK, MA
JEANNE VAN ORMAN		SOUTH EASTON, MA
JEFFREY JOHNSON		ROSLINDALE, MA
JERRY CARCHEDI		ROSLINDALE, MA
JIM O'LEARY		BOSTON, MA
JOANNE AGABABIAN		BOSTON, MA
JOANNE BUCILLA		JAMAICA PLAIN, MA
JOANNE CATALDO		ROSLINDALE, MA
JOANNE WHITEHEAD		ROSLINDALE, MA
JOE HEISLER		ROSLYNDALE, MA
JOHN F. GORMAN		BEVERLY, MA
JOHN F. MALPIEDE		BOSTON, MA
JOYCE PULLEY		ROSLINDALE, MA
JULIE SATTERFIELD		ROSLINDALE, MA
KATHLEEN ROWLINGS		HYDE PARK, MA
KENNETH SPOLSINO		HYDE PARK, MA
KEVIN MOLONEY		JAMAICA PLAIN, MA

NAME	REPRESENTING	CITY/STATE
LEONARD M. SINGER		NEWTON, MA
LESLIE ARNOLD		JAMAICA PLAIN, MA
LINDA PALMER		JAMAIDA PLAIN, MA
MARGARET NOCO		JAMAICA PLAIN, MA
MARIANNE ABRAMS		BOSTON, MA
MARTHA MEANEY		JAMAICA PLAIN, MA
MARY E. EAJAN		JAMAICA PLAIN, MA
MARY R. SEFCHUK		JAMAICA PLAIN, MA
MARY ROLFES		ROSLINDALE, MA
MICHAEL D. GOFF		READVILLE, MA
MICHAEL REISKIND		JAMAICA PLAIN, MA
MICHELE GISSEN		JAMAICA PLAIN, MA
NANCI SHAMMAS		ROSLINDALE, MA
NICHOLAS PALERMO		JAMAICA PLAIN, MA
NICOLAS C. DEMOSO		HYDE PARK, MA
NINA WILDS		ROSLINDALE, MA
PAUL & ANGELA LONG		ROSLINDALE, MA
PHILIP SHUTT		HOWARD, MA
RICHARD HARRIS		JAMAICA PLAIN, MA
RICHARD HILDEBRANT		JAMAICA PLAIN, MA
RICHARD JOHNSON		BELMONT, MA
RITA MANDOSA		ROSLINDALE, MA
ROBERT BROWN		NEWBURY, MA
ROBERT J. MATUSIK		MALDEN, MA
ROLAND E. BRILLON		ATTLEBORO, MA
SAM CONTI		HYDE PARK, MA
SHERRY GOLDEN		JAMAICA PLAIN, MA
STEPHEN MAKRIS		MANSFIELD, MA
STEVE KAISER		CAMBRIDGE, MA
SUSAN FLECK		ROSLINDALE, MA
SUSAN LEWIS		JAMAICA PLAIN, MA
THERESA HEISLER		ROSLINDALE, MA
THOMAS MAGUIRE		CANTON, MA
THOMAS MCDONAHUE		ROSLINDALE, MA
WENDY BLUNDELL		ROSLINDALE, MA
WILLIAM BLUNDELL, JR.		ROSLINDALE, MA
WILLIAM WHITE		JAMAICA PLAIN, MA
WINSTON LEWIS		ROSLINCALE, MA
DIRECTOR	ATTLEBORO PUBLIC LIBRARY	ATTLEBORO, MA
DIRECTOR	BOYDEN LIBRARY	FOXBORO, MA
DIRECTOR	CANTON PUBLIC LIBRARY	CANTON, MA
DIRECTOR	DEDHAM PUBLIC LIBRARY	DEDHAM, MA
STATE TRANSPORTATION LIBRARY	GEORGE SANGORN - REFERENCE LIBRARIAN	BOSTON, MA
BOSTON PUBLIC LIBRARY	GOVERNMENT DOCUMENTS - SHIPPING ENTRANCE	BOSTON, MA
BOSTON PUBLIC LIBRARY	HYDE PARK - SHIPPING ENTRANCE BLAGDEN ST.	BOSTON, MA
BOSTON PUBLIC LIBRARY	JAMAICA PLAIN - SHIPPING ENTRANCE BLAGDEN ST.	BOSTON, MA
BOSTON PUBLIC LIBRARY	KIRSTEIN BUSINESS - SHIPPING ENTRANCE BLAGDEN	BOSTON, MA
BOSTON PUBLIC LIBRARY	MAIN BRANCH - SHIPPING ENTRANCE BLAGDEN ST.	BOSTON, MA
DIRECTOR	MANSFIELD PUBLIC LIBRARY	MANSFIELD, MA
DIRECTOR	MORRILL MEMORIAL LIBRARY	NORWOOD, MA
DIRECTOR	NORTON PUBLIC LIBRARY	NORTON, MA
BOSTON PUBLIC LIBRARY	ROSLINDALE BRANCH - SHIPPING ENTRANCE BLAGDEN	BOSTON, MA

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BOSTON PUBLIC LIBRARY	ROXBURY DUDLEY - SHIPPING ENTRANCE BLAGDEN ST.	BOSTON, MA
BOSTON PUBLIC LIBRARY	ROXBURY EGLESTON SQ - SHIPPING ENTRANCE	BOSTON, MA
BOSTON PUBLIC LIBRARY	ROXBURY GROVE HALL - SHIPPING ENTRANCE BLAGDEN	BOSTON, MA
BOSTON PUBLIC LIBRARY	ROXBURY LITERACY CTR - SHIPPIN G ENT. BLAGDEN	BOSTON, MA
BOSTON PUBLIC LIBRARY	ROXBURY PARKER HILL - SHIPPING ENT. BLAGDEN	BOSTON, MA
BOSTON PUBLIC LIBRARY	S BOSTON WASHINGTON VILLAGE - SHIPPING ENT	BOSTON, MA
BOSTON PUBLIC LIBRARY	S. BOSTON BRANCH - SHIPPING ENTRANCE BLAGDEN	BOSTON, MA
BOSTON PUBLIC LIBRARY	S. END BOSTON - SHIPPING ENTRANCE BLAGDEN ST.	BOSTON, MA
DIRECTOR	SHARON PUBLIC LIBRARY	SHARON, MA
BOSTON PUBLIC LIBRARY	W. ROXBURY BRANCH - SHIPPING ENTRANCE BLAGDEN	BOSTON, MA
DIRECTOR	WESTWOOD PUBLIC LIBRARY	WESTWOOD, MA
CARL HANSON	HARRIS, MILER, MILLER AND HANSON	LEXINGTON, MA
MENG CHNG	KM CHANG ENVIRONMENTAL, INC.	WALTHAM, MA
BOB PEASE	ROY F. WESTON	WILIMINGTON, MA
CASSANDRA KOUTALIDIS	FREDERIC R. HARRIS	BOSTON, MA
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MR. EDWARD GALVIN, HISTORIAN	NEW HAVEN RR HISTORICAL/TECHNICAL ASSOCIATION	BRUNSWICK, ME
WAYNE DAVIS	TRAINRIDERS NORTHEAST	PORTLAND, ME
DAVID BRASLAU, PRESIDENT	MINN TECHNOLOGY CENTER, DAVID BRADLAU ASSOC.	MINNEAPOLIS, MN
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DONALD F. X. FINN	ALTERNATIVE RATING SYSTEMS	MILLINGTON, NJ
EDWARD BOLDEN, TRANS. PLANNER	LS TRANSIT SYSTEMS INC.	BLOOMFIELD, NJ
FREDERICK A. WINKLER	WINCHESTER & WESTERN RAILROAD	BRIDGETON, NJ
VINCENT TOMASELLI	WOODWARD CLYDE	WAYNE, NJ
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MATTHEW L. WALD	NEW YORK TIMES	NEW YORK, NT
ROBERT RUBENFELD	GOVERNMENT AFFAIRS DEPT. - METRO NORTH COMM.	NEW YORK, NY
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I. DAVID WIDAWSKY, CHIEF	EBASCO INFRASTRUCTURE, TRANSIT PLANNING GROUP	NEW YORK, NY
PETE MAZUREK & GERARD GRASSI	JOHNSON ENGINEERING CENTER, CIVIL ENG DEPT	TROY, NY
GREG JOHNSON	JOURNAL OF COMMERCE	NEW YORK, NY
DOUG BOEING	MAGLEV NEWS	NEW YORK, NY
DAVID ORDAS	METRO NORTH COMMUTER RAILROAD	NEW YORK, NY
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GEORGE HAIKALIS		NEW YORK, NY
S. CASHIN		YONKERS, NY
THURMON WENZL	NLOSH, R-44	CINCINATTI, OH
CHESTER SOUTHERN	FEDERAL RAILROAD ADMINISTRATION, REGIONAL DIR.	PORTLAND, OR
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RICHARD F. HILL	AMTRAK	PHILADELPHIA, PA
JOHN MEGARY	FEDERAL RAILROAD ADMINISTRATION, REGIONAL DIR.	PHILADELPHIA, PA
ROBERT FISHER	SEPTA	PHILADELPHIA, PA
J. D. COSSEL	CONRAIL	PHILADELPHIA, PA
JOHN HARGROVE	GANNETT FLEMMING INC.	CAMP HILL, PA
DOMINICK SAULINO	MICHAEL BAKER JR. INC.	CORAOPOLIS, PA
BARBARA GERMINI		PAWCATUCK, PA

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GORDON HOXIE	FEDERAL HIGHWAY ADMINISTRATION	PROVIDENCE, RI
FREDERICK J. VINCENT	ASSOCIANTE DIR., DEPT. OF ENVIRONMENTAL MGT.	PROVIDENCE, RI
RICHARD B. KALUNIAN	BRIDGE DESIGN ENG. DOT OF R.I.	PROVIDENCE, RI
MARK B. LAROCHE	ENVIRONMENTAL COUNCIL OF RHODE ISLAND	BRISTOL, RI
SUSAN MORRISON	OFFICE OF SYSTEMS PLANNING	PROVIDENCE, RI
WILLIAM R. CARCIERI, JR.	PUBLIC WORKS DOT	PROVIDENCE, RI
DANTE E. BOFFI JR., DIRECTOR	RHODE ISLAND DEPARTMENT OF TRANSPORTATION	PROVIDENCE, RI
ROBERT A. SHAWNER, DEP. ASST.	RHODE ISLAND DEPARTMENT OF TRANSPORTATION	PROVIDENCE, RI
MICHAEL C. MOAN	RHODE ISLAND DEPT. OF ADMINISTRATION -	PROVIDENCE, RI
PAUL SILVA	RHODE ISLAND DEPT. OF ADMINISTRATION -	PROVIDENCE, RI
DONALD J. DRIOMI	RHODE ISLAND DIST. 2 CONGRESSMAN REID	CRANSTON, RI
JOHN O'BRIEN	RHODE ISLAND DIVISION OF PLANNING	PROVIDENCE, RI
JAMES LANNI, ASSOC. ADMIN. ENG	RHODE ISLAND PUC	PROVIDENCE, RI
KEVIN J. NELSON	RI DIVISION OF PLANNING/OFFICE OF STRATEGIC	PROVIDENCE, RI
EDWARD F. SANDERSON	RI HISTORICAL PRESERVATION COMMISSION	PROVIDENCE, RI
GEORGE A PRETE	RI PORT AUTHORITY	WESTERLY, RI
JOHN RIENDEAU	RI PORT AUTHORITY	NORTH KINGSTOWN, RI
BRIAN TEFFT	RIDEM - DIVISION OF FISH AND WILDLIFE	WEST KINGSTON, RI
CAROLYN WEYMOUTH	RIDEM - OFFICE OF ENVIRONMENTAL COORDINATION	PROVIDENCE, RI
KAZEM FARHOUMAND	RIDOT	PROVIDENCE, RI
THOMAS A. CONBOY	RIDOT	PROVIDENCE, RI
THOMAS J. QUEENAN, SR. PLANNER	RIDOT	PROVIDENCE, RI
J. MICHAEL BENNETT	RIDOT - ASST CHIEF OF DESIGN	PROVIDENCE, RI
EDMUND T. PARKER	RIDOT - CHIEF OF DESIGN	PROVIDENCE, RI
JAMES R. CAPALDI	RIDOT - OFFICE OF THE CHIEF ENGINEER	PROVIDENCE, RI
JOSEPH A. PICCARDA	RIDOT - RIGHT OF WAY SECTION	PROVIDENCE, RI
JOHN T. VORRO	SR. CIVIL ENGINEER - RIDOT	PROVIDENCE, RI
DAVID C. DEPETRILLO	TOURISM AND COMMUNICATION	PROVIDENCE, RI
EDWARD SZYMANSKI, CHIEF	WATER RESOURCES	PROVIDENCE, RI
DEAN H. ALBRO, CHIEF	WETLANDS SECTION DEM	PROVIDENCE, RI
ALAN A. ARSENAULT	CHARLESTOWN, RI - DIRECTOR OF PUBLIC WORKS	CHARLESTOWN, RI
MICHAEL J. DELUCA	CRANSTON CITY PLANNING DEPARTMENT	CRANSTON, RI
PETER ALVITI	CRANSTON PUBLIC WORKS DIRECTOR	CRANSTON, RI
JOHN McALMONT	PRINCIPAL PLANNER - CENTRAL FALLS, RI	CENTRAL FALLS, RI
IVO STOCKAR	PRINCIPAL PLANNER - WARWICK, RI	WARWICK, RI
JOHN PALMIERI	PROVIDENCE PLANNING & DEVELOPMENT DEPARTMENT	PROVIDENCE, RI
DEBRA COX	PUBLIC ARCHAEOLOGY LAB	PAWTUCKET, RI
FERDINAND C. IHENACHO, P.E.	PUBLIC WORKS CENTER, DIRECTOR	PAWTUCKET, RI
KEVIN M. FLYNN	CRANSTON PLANNING DEPARTMENT	CRANSTON, RI
HONORABLE RONALD K. MACHTLEY	U.S. HOUSE OF REP. - DIST. 1 (RI)	PAWTUCKET, RI
HONORABLE JOHN F. REED	U.S. HOUSE OF REP. - DIST. 2 (RI)	CRANSTON, RI
SENATOR CLAIRBORNE PELL	U.S. SENATE	PROVIDENCE, RI
SENATOR JOHN H. CHAFEE	U.S. SENATE	PROVIDENCE, RI
CHRISTINE GRINNEL	CONGRESSMAN REED'S OFFICE	WARWICK, RI
BARBARA COTTARN	GOVERNOR'S OFFICE	PROVIDENCE, RI
GOVERNOR BRUCE SUNDLUN	RHODE ISLAND STATE HOUSE	PROVIDENCE, RI
REP. JOHN J, MCCAULEY,JR	RI GENERAL ASSEMBLY - DIST. 1	PROVIDENCE, RI
REP. PETER N. WASYLYK	RI GENERAL ASSEMBLY - DIST. 10	PROVIDENCE, RI
REP. BAMBILYN B. CAMBIO	RI GENERAL ASSEMBLY - DIST. 11	NORTH PROVIDENCE, RI

NAME	REPRESENTING	CITY/STATE
REP. STEVEN F. SMITH	RI GENERAL ASSEMBLY - DIST. 12	PROVIDENCE, RI
REP. CHARLENE LIMA	RI GENERAL ASSEMBLY - DIST. 13	PROVIDENCE, RI
REP. FRANK T. CAPRIO	RI GENERAL ASSEMBLY - DIST. 14	PROVIDENCE, RI
REP. BRIAN PATRICK KENNEDY	RI GENERAL ASSEMBLY - DIST. 15X	ASHAWAY, RI
REP. PATRICK J. KENNEDY	RI GENERAL ASSEMBLY - DIST. 16	PROVIDENCE, RI
REP. MARY C. ROSS	RI GENERAL ASSEMBLY - DIST. 17	PROVIDENCE, RI
REP. JOSEPH E. NEWSOME	RI GENERAL ASSEMBLY - DIST. 18	PROVIDENCE, RI
REP. HAROLD M. METTS	RI GENERAL ASSEMBLY - DIST. 19	PROVIDENCE, RI
REP. PAUL E. MOURA	RI GENERAL ASSEMBLY - DIST. 2	PROVIDENCE, RI
REP. GOERGE A. CASTRO	RI GENERAL ASSEMBLY - DIST. 20	PROVIDENCE, RI
REP. PAUL H. ARCHETTO	RI GENERAL ASSEMBLY - DIST. 21	CRANSTON, RI
REP. BEATRICE A. LANZI	RI GENERAL ASSEMBLY - DIST. 22	CRANSTON, RI
REP. JAMES J. GINOLFI	RI GENERAL ASSEMBLY - DIST. 23	CRANSTON, RI
REP. FRANK A. MONTANARO	RI GENERAL ASSEMBLY - DIST. 24	CRANSTON, RI
REP. JOSEPH A. DELORENZO JR.	RI GENERAL ASSEMBLY - DIST. 25	CRANSTON, RI
REP. ROBERT B. JACQUARD	RI GENERAL ASSEMBLY - DIST. 26	CRANSTON, RI
REP. JOHN S. SIMONIAN	RI GENERAL ASSEMBLY - DIST. 27	CRANSTON, RI
REP. SUSAN E. DEVENEY	RI GENERAL ASSEMBLY - DIST. 28	CRANSTON, RI
REP. JAMES R. LANGEVIN	RI GENERAL ASSEMBLY - DIST. 29	WARWICK, RI
REP. EDITH H. AJELLO	RI GENERAL ASSEMBLY - DIST. 3	PROVIDENCE, RI
REP. PAUL V. SHERLOCK	RI GENERAL ASSEMBLY - DIST. 30	WARWICK, RI
REP. LEONIDAS P. RAPTAKIS	RI GENERAL ASSEMBLY - DIST. 31	COVENTRY, RI
REP. EILEEN S. NAUGHTON	RI GENERAL ASSEMBLY - DIST. 32	WARWICK, RI
REP. PETER T. GINAITT	RI GENERAL ASSEMBLY - DIST. 33	WARWICK, RI
REP. ROBERT E. FLAHERTY	RI GENERAL ASSEMBLY - DIST. 34	WARWICK, RI
REP. GEORGE A. ZAINYEH	RI GENERAL ASSEMBLY - DIST. 35	WARWICK, RI
REP. RUSSEL BRAMLEY	RI GENERAL ASSEMBLY - DIST. 36	WARWICK, RI
REP. WILLIAM C. MCGOWAN	RI GENERAL ASSEMBLY - DIST. 37	WARWICK, RI
REP. LINDA J. KUSHNER	RI GENERAL ASSEMBLY - DIST. 4	PROVIDENCE, RI
REP. ROBERT A. WATSON	RI GENERAL ASSEMBLY - DIST. 43	EAST GREENWICH, RI
REP. SUZANNE M. HENSELER	RI GENERAL ASSEMBLY - DIST. 44	PROVIDENCE, RI
REP. MELVOID J. BENSON	RI GENERAL ASSEMBLY - DIST. 45	NORTH KINGSTOWN, RI
REP. KENNETH CARTER	RI GENERAL ASSEMBLY - DIST. 46	SAUNDERSTOWN, RI
REP. CHARLES T. KNOWLES	RI GENERAL ASSEMBLY - DIST. 47	NARRAGANSETT, RI
REP. DONALD J. LALLY,JR.	RI GENERAL ASSEMBLY - DIST. 48	PROVIDENCE, RI
REP. LEONA A. KELLEY	RI GENERAL ASSEMBLY - DIST. 49	PEACE DALE, RI
REP. GORDON D. FOX	RI GENERAL ASSEMBLY - DIST. 5	PROVIDENCE, RI
REP. DAVID J. PANCIERA	RI GENERAL ASSEMBLY - DIST. 50	WESTERLY, RI
REP. MARY LOU WALTER	RI GENERAL ASSEMBLY - DIST. 51	WESTERLY, RI
REP. RODNEY D. DRIVER	RI GENERAL ASSEMBLY - DIST. 52	WEST KINGSTON, RI
REP. JOHN J. DESIMONE	RI GENERAL ASSEMBLY - DIST. 6	PROVIDENCE, RI
REP. JOSEPH L. FARIA	RI GENERAL ASSEMBLY - DIST. 72	CENTRAL FALLS, RI
REP. ROBERT R. BROUSSEAU	RI GENERAL ASSEMBLY - DIST. 73	CENTRAL FALLS, RI
REP. MARK M. MONTALBANO	RI GENERAL ASSEMBLY - DIST. 74	NORTH PROVIDENCE, RI
REP. WILLIAM SAN BENTO, JR.	RI GENERAL ASSEMBLY - DIST. 75	PAWTUCKET, RI
REP. JOHN B. HARWOOD	RI GENERAL ASSEMBLY - DIST. 76	PROVIDENCE, RI
REP. MABEL M. ANDERSON	RI GENERAL ASSEMBLY - DIST. 77	PAWTUCKET, RI
REP. ELAINE A. CODERRE	RI GENERAL ASSEMBLY - DIST. 78	PAWTUCKET, RI
REP. ANTONIO J. PIRES	RI GENERAL ASSEMBLY - DIST. 79	PAWTUCKET, RI
REP. THOMAS A. PALANGIO	RI GENERAL ASSEMBLY - DIST. 8	PROVIDENCE, RI
REP. PETER F. KILMARTIN	RI GENERAL ASSEMBLY - DIST. 80	PAWTUCKET, RI
REP. EUGENE F. GARVEY	RI GENERAL ASSEMBLY - DIST. 81	WAKEFIELD, RI

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REP. ANASTASIA WILLIAMS	RI GENERAL ASSEMBLY - DIST. 9	PROVIDENCE, RI
SENATOR MARYELLEN GOODWIN	RI STATE SENATE - DIST. 1	PROVIDENCE, RI
SENATOR ROBERT T. KELLS	RI STATE SENATE - DIST. 10	PROVIDENCE, RI
SENATOR WILLIAM P. FITZPATRICK	RI STATE SENATE - DIST. 11	CRANSTON, RI
SENATOR JOHN O'LEARY	RI STATE SENATE - DIST. 12	CRANSTON, RI
SENATOR THOMAS J. IZZO	RI STATE SENATE - DIST. 13	CRANSTON, RI
SENATOR ELEANOR C. SASSO	RI STATE SENATE - DIST. 14	CRANSTON, RI
SENATOR EDWARD J. LAWRENCE	RI STATE SENATE - DIST. 15	WARWICK, RI
SENATOR JOSEPH J. MCGAIR	RI STATE SENATE - DIST. 16	WARWICK, RI
SENATOR THOMAS A. LYNCH	RI STATE SENATE - DIST. 17	PROVIDENCE, RI
SENATOR JOHN C. REVENS, JR.	RI STATE SENATE - DIST. 18	WARWICK, RI
SENATOR MYRTH YORK	RI STATE SENATE - DIST. 2	PROVIDENCE, RI
SENATOR J. MICHAEL LENIHAN	RI STATE SENATE - DIST. 22	EAST GREENWICH, RI
SENATOR ROBIN PORTER	RI STATE SENATE - DIST. 23	NORTH KINGSTOWN, RI
SENATOR DOMENIC A. DISANDRO	RI STATE SENATE - DIST. 24	SAUNDERSTOWN, RI
SENATOR W. MICHAEL SULLIVAN	RI STATE SENATE - DIST. 25	WEST KINGSTON, RI
SENATOR DENNIS L. ALGIERE	RI STATE SENATE - DIST. 26	WESTERLY, RI
SENATOR RHODA E. PERRY	RI STATE SENATE - DIST. 3	PROVIDENCE, RI
SENATOR DANIEL J. ISSA	RI STATE SENATE - DIST. 35	CENTRAL FALLS, RI
SENATOR ANTHONY R. MARCIANO	RI STATE SENATE - DIST. 36	NORTH PROVIDENCE, RI
SENATOR JOSEPH A. MONTALBANO	RI STATE SENATE - DIST. 37	NORTH PROVINDENCE, RI
SENATOR JOHN F. MCBURNEY,III	RI STATE SENATE - DIST. 38	PAWTUCKET, RI
SENATOR WILLIAMS V. IRONS	RI STATE SENATE - DIST. 39	RUMFORD, RI
SENATOR DOMINICK J. RUGGERIO	RI STATE SENATE - DIST. 4	PROVIDENCE, RI
SENATOR HAROLD J. MILLER,JR	RI STATE SENATE - DIST. 40	PAWTUCKET, RI
SENATOR BRADFORD GORHAM	RI STATE SENATE - DIST. 41	FOSTER, RI
SENATOR PAUL J. TAVARES	RI STATE SENATE - DIST. 42	EAST PROVIDENCE, RI
SENATOR JAMES P. MCSTAY	RI STATE SENATE - DIST. 43	EAST PROVIDENCE, RI
SENATOR DAVID E. BATES	RI STATE SENATE - DIST. 44	BARRINGTON, RI
SENATOR CATHERINE E. GRAZIANO	RI STATE SENATE - DIST. 5	PROVIDENCE, RI
SENATOR WALTER J. GRAY	RI STATE SENATE - DIST. 6	KINGSTOWN, RI
SENATOR JOHN J. BEVILACQUA	RI STATE SENATE - DIST. 7	PROVIDENCE, RI
SENATOR JOHN ORABONA	RI STATE SENATE - DIST. 8	PROVIDENCE, RI
SENATOR CHARLES D. WALTON	RI STATE SENATE - DIST. 9	PROVIDENCE, RI
SENATOR MAVERN, CHAIRMAN	STATE HOUSE	PROVIDENCE, RI
THOMAS LAZIEH	MAYOR OF CENTRAL FALLS	CENTRAL FALLS, RI
HON. MICHAEL A. TRAFICANTE	MAYOR OF CRANSTON, RI	CRANSTON, RI
HONORABLE ROBERT E. METIVIER	MAYOR OF PAWTUCKET, RI	PAWTUCKET, RI
HON. VINCENT A. CIANCI, JR.	MAYOR OF PROVIDENCE, RI	PROVIDENCE, RI
HONORABLE LINCOLN CHAFEE	MAYOR OF WARWICK, RI	WARWICK, RI
HONORABLE THOMAS LAZIEH	MAYOR OF WICKFORD, RI	WICKFORD, RI
ELIZABETH MOWCHAN	RICHMOND TOWN COUNCIL PRESIDENT	WYOMING, RI
GEORGE HIBBARD	TOWN ADMINISTRATOR	CHARLESTOWN, RI
WILLIAM DEVANEY	TOWN COUNCIL PRESIDENT - EXETER	EXETER, RI
JONATHAN STEVENS	DIRECTOR OF PLANNING	WARWICK, RI
MARILYN COHEN	DIRECTOR OF PLANNING	N. KINGSTOWN, RI
MICHAEL CASSIDY	DIRECTOR OF PLANNING	PAWTUCKET, RI
NANCY HESS	DIRECTOR OF PLANNING	WESTERLY, RI
RICHARD CRENEN	DIRECTOR OF PUBLIC WORKS	NORTH KINGSTOWN, RI
RICHARD J. GOLDSTEIN, CLERK	PAWTUCKET, RI CITY HALL	PAWTUCKET, RI
DEBORAH PERRY	PLANNING CONSULTANT	CHARLESTOWN, RI

NAME	REPRESENTING	CITY/STATE
VINCENT MURRAY	PLANNING DIRECTOR	EAST GREENWICH, RI
CHIEF ALFRED BERTCINI	PROVIDENCE, RI FIRE DEPARTMENT	PROVIDENCE, RI
JOSEPH LOMBARDO	RICHMOND TOWN PLANNER	WYOMING, RI
BARBARA LEARNED	TOWN COUNCIL	NORTH KINGSTOWN, RI
HONORABLE CALVIN ELLIAS	TOWN COUNCIL PRESIDENT - EXETER, RI	EXETER, RI
HONORABLE LINDA PERRA	TOWN COUNCIL PRESIDENT - HOPKINTON, RI	HOPKINTON, RI
WILLIAM SEQUINO, JR.	TOWN MANAGER - EAST GREENWICH, RI	EAST GREENWICH, RI
RICHARD KERBEL	TOWN MANAGER - NORTH KINGSTOWN	NORTH KINGSTOWN, RI
STEPHEN A. ALFRED	TOWN MANAGER - SOUTH KINGSTOWN, RI	WAKEFIELD, RI
ERNEST ZMYSLINSKY	TOWN MANAGER - WESTERLY, RI	WESTERLY, RI
DAN ARSENAULT	TOWN OF CHARLESTOWN, RI	CHARLESTOWN, RI
JOSEPH LOMBARDO	TOWN PLANNER	HOPKINTON, RI
ANTHONY J. LACHOWICZ	TOWN PLANNER - SOUTH KINGSTOWN	WAKEFIELD, RI
BARRY COLE	WESTERLY, RI TOWN COUNCIL	WESTERLY, RI
BRIAN H. MANNING		COVENTRY, RI
BRUCE HAMILTON		SAUNDERSTOWN, RI
OSCAR K. SHELTON, JR.		WARWICK, RI
ROBERT J. JUDGE		EXETER, RI
ROY J. DEMPSEY		WARWICK, RI
SARAH F. BLIVEN		KENYON, RI
EUGENIA MARKS	AUDUBON SOCIETY OF R.I.	SMITHFIELD, RI
DOUGLAS MANCASH	BB&S LUMBER	DAVISVILLE, RI
JOHN HOWELL	BEACON COMMUNICATIONS INC	WARWICK, RI
CLAIRE DAVA	C.O.N.C.E.R.N.	NORTH KINGSTOWN, RI
CINDY ROPER	CLEAN WATER ACTION/NEW ENGLAND	PROVIDENCE, RI
ABBOTT W. DRESSLER EXEC VP	COLFAX, INC.	PAWTUCKET, RI
KAREN SALVATORE	DOT WATCH	SAUNDERSTOWN, RI
WINSTON STADIG	DOT WATCH	NORTH KINGSTOWN, RI
PAUL BEAUDETTE	ECRI	WARWICK, RI
THOMAS A. DUPREE, CHIEF	FOREST ENVIRONMENT	NORTH SCITUATE, RI
GERALD M. GANNON, PRES.	G. M. GANNON CO., INC.	WARWICK, RI
BILLINGS L. MANN, JR., VP-SEC	GEROGE MANN & CO, INC.CO.	PROVIDENCE, RI
ERNEST DECHENE	INTERNATIONAL BROTHERHOOD OF ELECTRICAL	NORTH KINGSTOWN, RI
STEPHEN A. MIELE	INTERNATIONAL BROTHERHOOD OF ELECTRICAL	WARWICK, RI
VICTOR A. BREAULT, OPERATIONS	JOHNSON BROS. OF R.I. CO.	WEST DAVISVILLE, RI
WILLIAM WATKINS, JR. EXEC VP	NARRAGANSETT ELECTRIC CO.	PROVIDENCE, RI
GEORGE M. HOPKINS, CHF SACHEM	NARRAGANSETT INDIAN TRIBE	CHARLESTOWN, RI
ROY POULSEN	NATIONAL ASSOCIATION OF RAILROAD PASSENGERS	KINGSTON, RI
MICHAEL MIRANDA, PRES.	NORAD	N. KINGSTOWN, RI
WILLIAM G. BRODY	NORTHEAST CORRIDOR INITIATIVE	PROVIDENCE, RI
JAMES P. REPASS	NORTHEAST CORRIDOR INITIATIVE - PRESIDENT	PROVIDENCE, RI
JANET WHITE, VP	PROVIDENCE CHAMBER OF COMMERCE	PROVIDENCE, RI
CITY EDITOR	PROVIDENCE EVENING BULLETIN	PROVIDENCE, RI
ROBERT FREEMAN	PROVIDENCE FOUNDATION	PROVIDENCE, RI
ANDY BURKHARDT	PROVIDENCE JOURNAL	PROVIDENCE, RI
GEL CALBONE	PROVIDENCE JOURNAL	PROVIDENCE, RI
TONY DEPAUL	PROVIDENCE JOURNAL NEWS	WARWICK, RI
MICHAEL A. BLACKBURN	QUEBECOR PRINTING	PROVIDENCE, RI
E. A. TANSEY	RHODE ISLAND AIRPORT CORPORATION	WARWICK, RI
STEVEN H. MUSEN	RHODE ISLAND ASSOC OF RAILROAD PASSENGERS	WARWICK, RI
EVERETT STUART	RHODE ISLAND ASSOCIATION OF RAILROAD	NORTH KINGSTOWN, RI
BARRY SCHILLER	RHODE ISLAND SIERRA CLUB	NORTH PROVIDENCE, RI

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DERRICK VANLENT	RI SCHOOL OF DESIGN - LANDSCAPE ARCHITECTURE	PROVIDENCE, RI
DONALD A. McCARTHY	RIAOP	WARWICK, RI
RAY RICARD	RIARRP	WARWICK, RI
DIANE WILLIAMSON	SAI	JAMESTOWN, RI
ALISON WALSH	SAVE THE BAY	PROVIDENCE, RI
CURT SPALDING	SAVE THE BAY	PROVIDENCE, RI
BRIAN A. SWEENEY, GEN. MGR.	SEAFREEZE LTD.	N. KINGSTON, RI
KEVIN P. SMITH	SMITH AND ASSOCIATES	SHANNOCK, RI
RON DOMOUCHEL	THE NARRAGANSETT ELECTRIC COMPANY	NORTH KINGSTOWN, RI
WILLIAM WATKINS, JR	THE NARRAGNASETT ELECTRIC COMPANY	PROVIDENCE, RI
DANIEL A. BAUDOUIN, DIR.	THE PROVIDENCE FOUNDATION	PROVIDENCE, RI
LOUIS LASKER	UNITED ENERGY SYSTEMS , INC.	CUMBERLAND, RI
ROBERT A. CIOE	VALLEY BROOK PARTNERS	WARWICK, RI
JUDITH L. CROWLEY	VRI/IPAP	CRANSTON, RI
FRANK GENTILE	WALKER'S DOCK	HOPKINGTON, RI
JEFF MILL	WESTERLY SUN	WESTERLY, RI
MATT COLLINS	WESTERLY SUN	WESTERLY, RI
RORY O'NEILL	WPRO	EAST PROVIDENCE, RI
A. KENT BAILEY		WESTERLY, RI
ALBERT GREENE		CHARLESTOWN, RI
ANTHONY S. MASI		NORTH PROVIDENCE, RI
BARB AND STEVE WHEELER		SHANNOCK, RI
BOB JUDGE		EXETER, RI
C. R. BLYDENBURGH		WAKEFIELD, RI
CLIFF VANOVER		CHARLESTOWN, RI
DANIEL W. VARIN		PROVIDENCE, RI
DENNIS R. PRIOR		CRANSTON, RI
DONALD McCRA		PAWTUCKET, RI
ED McGUNAGLE		CRANSTON, RI
FRED SULLIVAN		WARWICK, RI
FREDERICK F. HORAN		CUMBERLAND, RI
IVAR GUSTAFSON		CRANSTON, RI
J. FOLEY		CRANSTON, RI
J. WILLIAM HARSCH		PROVIDENCE, RI
JERRY WHITMAN		CAROLINA, RI
JOHN J. GILSY		CRANSTON, RI
JOSEPH A. PALMER		WARWICK, RI
JOSEPH ALLEN		NORTH KINGSTOWN, RI
JOYCE GREENE		CHARLESTOWN, RI
KENT BAILEY		WESTERLY, RI
LARRY CARRERA		NORTH KINGSTOWN, RI
LINDA SEILER		EAST GREENWICH, RI
LORAINE TISDALE		CRANSTON, RI
MARGARET PEASE		CHARLESTOWN, RI
MARILYN BAKER		WARWICK, RI
MICHAEL LECKIE		HOPE VALLEY, RI
MR. & MRS. PRESTON PELKEY		WARWICK, RI
P. CIMENO		CHARLESTOWN, RI
PAT OLINACAPILLE		NORTH KINGSTON, RI
PAUL A. WAND		WARWICK, RI
PAUL F. GOLEGO		EAST GREENWICH, RI
PAUL J. CROWDOW		WEST GREENWICH, RI

NAME	REPRESENTING	CITY/STATE
RAE MARIE GILBERT		WAKEFIELD, RI
RAYMOND G. RICARD		WARWICK, RI
RAYMOND THORNTON		WOOD RIVER JCT., RI
RENA TAVANIAN		CRANSTON, RI
RICHARD F. NAGELE		WICKFORD, RI
ROBERT MAHONEY		CRANSTON, RI
ROBERT ROMER		KENYON, RI
STEVE ELIAS		BARRINGTON, RI
THOMAS P. CARNEVALE		SMITHFIELD, RI
W. CHARETTE		WOOD RIVER JUNCTION, RI
W.L. GILBERT		WAKEFIELD, RI
CENTRAL FALLS FREE PUB. LIB.	CENTRAL FALLS, RI	CENTRAL FALLS, RI
PROVIDENCE PUBLIC LIBRARY	CENTRAL LIBRARY	PROVIDENCE, RI
CROSSMILLS PUBLIC LIBRARY	CHARLESTOWN, RI	CHARLESTOWN, RI
CRANSTON PUBLIC LIBRARY	CRANSTON, RI	CRANSTON, RI
EAST GREENWICK PUBLIC LIBRARY	EAST GREENWICH, RI	EAST GREENWICH, RI
PROVIDENCE PUBLIC LIBRARY	FOX POINT BRANCH LIBRARY	PROVIDENCE, RI
DIRECTOR	FOX POINT LIBRARY	PROVIDENCE, RI
LANGWORTHY LIBRARY	HOPKINTON, RI	HOPKINTON, RI
DIRECTOR	KNIGHT MEMORIAL LIBRARY	PROVIDENCE, RI
PROVIDENCE PUBLIC LIBRARY	KNIGHT MEMORIAL LIBRARY	PROVIDENCE, RI
DIRECTOR	MT. PLEASANT BRANCH LIBRARY	PROVIDENCE, RI
PROVIDENCE PUBLIC LIBRARY	MT. PLEASANT BRANCH LIBRARY	PROVIDENCE, RI
NORTH KINGSTOWN PUBLIC LIBRARY	NORTH KINGSTOWN, RI	NORTH KINGSTOWN, RI
DIRECTOR	OLNEYVILLE BRANCH LIBRARY	PROVIDENCE, RI
PROVIDENCE PUBLIC LIBRARY	OLNEYVILLE BRANCH LIBRARY	PROVIDENCE, RI
PAWTUCKET & REG. LIBRARY CTR	PAWTUCKET, RI	WARWICK, RI
SOUTH KINGSTOWN PUBLIC LIBRARY	PEACEDALE, RI	PEACEDALE, RI
PROVIDENCE PUBLIC LIBRARY	PROVIDENCE, RI	PROVIDENCE, RI
DIRECTOR	ROBERT BEVERLY HALE LIBRARY	WAKEFIELD, RI
PROVIDENCE PUBLIC LIBRARY	ROCHAMBEAU BRANCH LIBRARY	PROVIDENCE, RI
PROVIDENCE PUBLIC LIBRARY	S. PROVIDENCE BRANCH LIBRARY	PROVIDENCE, RI
PROVIDENCE PUBLIC LIBRARY	SMITH HILL BRANCH LIBRARY	PROVIDENCE, RI
DIRECTOR	WANSKUCK BRANCH LIBRARY	PROVIDENCE, RI
PROVIDENCE PUBLIC LIBRARY	WANSKUCK BRANCH LIBRARY	PROVIDENCE, RI
WARWICK PUBLIC LIBRARY	WARWICK, RI	WARWICK, RI
DIRECTOR	WASHINGTON PARK BRANCH LIBRARY	PROVIDENCE, RI
PROVIDENCE PUBLIC LIBRARY	WASHINGTON PARK BRANCH LIBRARY	PROVIDENCE, RI
WESTERLY PUBLIC LIBRARY	WESTERLY, RI	WESTERLY, RI
SHAFTER H. STOTTS, JR.	FEDERAL RAILROAD ADMINISTRATION, REGIONAL DIR.	HURST, TX
TERRY DUDLEY	MORRISON KNUDSEN CORPORATION	AUSTIN, TX
BOB DAVIS	RADIAN CORPORATION	AUSTIN, TX
WILLIAM HARRIS, SCD., P.E.,	TEXAS A&M UNIV., COLLEGE OF ENGINEERING	COLLEGE STATION, TX
E.L. TENNYSON, P.E.,	FEDERAL DEPT. OF PUBLIC WORKS, PLANNING	ARLINGTON, VA
PAULA GOGGIN	AP KEARNEY	ALEXANDRIA, VA
H. DUKE NIEBUR	MTMC, TRANS. ENGINEERING AGENCY	NEWPORT NEWS, VA
JENNIFER JONES	STRA	ARLINGTON, VA
W. THOMAS CALLAHAN, V.P.	UNIFIED INDUSTRIES INC.	SPRINGFIELD, VA

♦ Appendix I

Key Correspondence

Federal Emergency Management Agency
Region I
J.W. McCormack Post Office and Courthouse Building
Boston, Massachusetts 02109

June 29, 1994

Robert J. DeSista
Chief, Permits Branch
Regulatory Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Attn: Susan K. Lee

RE: Public Notice File No. 1992-02685N

Dear Mr. DeSista:

This is a follow-up to our letter dated November 24, 1993 in which we responded to your request for comments on the referenced Public Notice, a request by the National Railroad Passenger Corporation (AMTRAK) to conduct activities in navigable waters in conjunction with the electrification of the Northeast Corridor Rail Line between New Haven, Connecticut and Boston, Massachusetts.

As you are aware, our concerns focused on the project's impact to special flood hazard areas identified by the National Flood Insurance Program. Since our November 24, 1993 letter and subsequent letter dated June 13, 1994, we have received additional information from Morrison Knudsen/L.K. Comstock/Spie Group, a.k.a. A Joint Venture. Based on the data provided to us, our concerns, specified in our previous letters have been adequately addressed.

Should you have any questions regarding these comments, or the National Flood Insurance Program in general, please contact Mr. Gregory Ormsby of this office at (617) 223-9561. Thank you for your continued support of the National Flood Insurance Program.

Sincerely,

Albert A. Gammal, Jr., Director
Mitigation Division

cc: J. Gorman, A Joint Venture
J. Northrup, CT Dept. of Environmental Protection
T. Watkins, Town of Stonington, CT

Federal Emergency Management Agency
Region I
J.W. McCormack Post Office and Courthouse Building
Boston, Massachusetts 02109

June 13, 1994

Robert J. DeSista,
Chief, Permits Branch
Regulatory Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Attn: Susan K. Lee

RE: Public Notice File No. 1992-02685N

Dear Mr. DeSista:

The purpose of this letter is to respond to the May 26, 1994 letter from Morrison Knudsen/L.K. Comstock/SPIE Group (a.k.a. Joint Venture), addressing our concerns about the impact of the Stonington, Leetes Island, Richmond and New London Electrical Facility Stations to Special Flood Hazard Areas identified by the National Flood Insurance Program (NFIP).

With regards to the issues brought forth in our November 24, 1993 letter to Mr. Glenn Goulet, USDOT/RSPA, our concerns for compensatory storage have been adequately addressed for the Leetes Island, Richmond and New London Electrical Facility Stations.

However, we are very concerned with Joint Venture's proposal to locate the Stonington Paralleling Station within a "Zone V10 (el 14)." As we stated in the November 24, 1993 letter:

> "It appears that the Stonington Paralleling Station is proposed to be constructed in 'Zone V10 (el 14).' By placing the paralleling station in this zone, the station is susceptible to not only flooding but the impact of **wave-action** from the 100-year event. It is our recommendation that the paralleling station be removed from the 'Zone V' and the site be relocated outside of a designated flood hazard area, unless it is shown that there are no practicable alternatives to locating the station at that site."

At this time, our office has not been provided with an adequate explanation as to why this paralleling station must be located in the Zone V10 (el 14). Additionally, the applicant should be aware of the requirements that govern construction within a Zone V (see Section 60.3(e) of enclosure).

Information provided by Mr. Stephen Gazillo of Joint Venture, shows that a building/structure is to constructed on a filled area within the Zone V. For clarification, a building/structure is defined by the NFIP as:

> ". . . a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home. . ."

Additionally, Section 60.3(e)(6) of the NFIP minimum requirements states that the community shall:

> "Prohibit the use of fill for structural support of buildings within Zones V1-30, VE, and V on the community's FIRM."

Presently, the engineering methods of Joint Venture for construction in a Zone V do not meet the minimum requirements of the NFIP. Unless construction of the building/structure conforms to the requirements of Section 60.3(e) or the paralleling station is relocated outside of the Zone V, we strongly recommend that the applicant not receive a Section 404 permit for this project.

For further information concerning the NFIP, you can contact the State Coordinator for the National Flood Insurance Program, Mr. Jay Northrup, with the Connecticut Department of Environmental Protection, at (203) 566-7244. Should you have any questions regarding specific recommendations and requests made in this letter, please contact Mr. Gregory Ormsby or Mr. David Knowles of this office at (617) 223-9561. Thank you for your continued support of the National Flood Insurance Program.

Sincerely,

Albert A. Gammal, Jr., Director
Mitigation Division

Enclosure

cc: R. Kendall, Joint Venture
J. Northrup, CT Dept. of Environmental Protection
T. Watkins, Town of Stonington, CT

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director*

Jim Fougere
The Smart Associates
Environmental Consultants, Inc.
72 No. Main Street, Suite 1
Concord, N.H. 03301-4983

August 18, 1994

RE: Amtrak Electrification

Dear Jim:

Sorry for not notifying you sooner regarding any Division of Fisheries & Wildlife (DFW) concerns regarding the subject project, however it took me some time to receive word from our districts due to the end of the fiscal year madness. At any rate, we do not anticipate any serious impacts from fencing and we do not see the need for any seasonal restrictions.

If you should have any questions or concerns regarding hunting seasons in the vicinity of your ROW please contact the appropriate DFW office. If I may be of furthur assistance please do not hesitate to call.

Very truly yours,

William J. Minior
Chief of Wildlife Lands

Division of Fisheries & Wildlife
Leverett Saltonstall Building,
Government Center, 100 Cambridge Street, Boston, MA 02202 (617) 727-3151
An Agency of the Department of Fisheries, Wildlife & Environmental Law Enforcement

City Of Attleboro, Massachusetts

DEPARTMENT OF PLANNING & LAND USE
Government Center, 77 Park Street
Attleboro, Massachusetts 02703
508-223-2222 • Fax 508-222-3046

LANDIS E. HERSHEY
CONSERVATION AGENT

Robert A. Kendall, Project Director
Morrison Knudsen/L.K. Comstock/Spie Group
333 Elm Street
Dedham, MA 02026

June 7, 1994

Dear Mr. Kendall,

This letter is to inform you I have reviewed and concurred with the wetlands delineation at the site of the proposed Amtrak electrical switching station off of Richardson Avenue in Attleboro. I reviewed the wetlands delineation line at a site visit on May 31, 1994 with Mr. John F. Gorman of Morrison Knudsen Corporation and I found it to comply with the 310 CMR 10.00 Massachusetts Wetlands Protection Act standards for wetlands delineation.

If you have any further questions please give me a call.

Sincerely,

Landis E. Hershey

Landis E. Hershey
Conservation Agent

FROM THE OFFICE OF THE

Conservation Commission

SHARON, MASSACHUSETTS

April 25, 1994

William R. Zemaitis
Gannett Fleming, Inc.
650 Park Ave. Suite 100
P.O. Box 60368
King of Prussia, PA 19406

Dear Bill:

Upon my review of the wetland delineation associated with the proposed Amtrack Electrification Project, I offer the following comments:

1. Some minor flag relocation was required during the March site visit.

2. The final flag locations represented what I consider to be an accurate wetland resource boundary delineation.

3. I will recommend that the Conservation Commission approve this delineation upon your filing.

Should you require further communication, feel free to call.

Sincerely,

Gregory Meister

Gregory Meister
Conservation Agent

GM/dm

♦ Appendix J

Siting Analysis for Connecticut Substation Alternatives

APPENDIX J
SITING ANALYSIS
FOR CONNECTICUT SUBSTATION ALTERNATIVES

Among the major comments received on the DEIS/R were those relating to the placement of substation facilities in Connecticut. The Connecticut Siting Council requested that information be provided detailing alternative locations for substation sites in Connecticut. The following analysis provides a detailed discussion of environmental and technical considerations for the facility sitings in Connecticut. The analysis covers the issues and concerns appropriate to the commenter.

SITING ANALYSIS FOR CONNECTICUT SUBSTATION ALTERNATIVES

Overall technical considerations on the Northeast Corridor electrification between New Haven and Boston concluded that some of the electrical substation facilities should be located in Connecticut. Further site-specific screening along the rail corridor identified alternative sites for the substations. Based on Amtrak technical and environmental screening considerations, four alternative sites were identified for the Branford area and three for the New London area (see Table J-1). The following is a summary of potential impacts from these alternatives on environmental resources, including noise and aesthetic damage to nearby cultural land features, parks, hospitals, schools, and residential development. This summary is abstracted from the *Draft Northend Electrification Project Evaluation of Preferred Electrical Facility Sites in Connecticut, Rhode Island and Massachusetts*, Morrison Knudsen/L.K. Comstock/Spie Group, March 14, 1994, which is available for review on request. Based on environmental and technical impacts, the Branford and New London locations were identified as the proposed sites for further consideration as part of the Proposed Action.

TABLE J-1 Connecticut Substation Alternatives

AREA	SITE	MILEPOST	LOCATION
Branford	Branford	79.03	Branford, CT
	New Haven	73.64	New Haven, CT
	East River	89.69	Guilford, CT
	Madison	92.87	Madison, CT
New London	New London	123.56	New London, CT
	Waterford	120.04	Waterford, CT
	Millstone	117.56	Waterford, CT

Source: Morrison Knudsen/L.K. Comstock/Spie Group, 1994

Branford Area Alternative

Branford

The proposed Branford site and transmission line ROW fall within the property of the Connecticut Department of Transportation (ConnDOT) and the South Central Connecticut Regional Water Authority (SCCRWA). The ConnDOT property is part of the former turnpike tollgate plaza. ConnDOT plans to use the property immediately adjacent to I-95 as a staging area for the reconstruction of the Lake Saltonstall Bridge; therefore, the back portion of the ConnDOT property would be available for the traction power substation. The SCCRWA property is a primarily wooded area and falls within the Furnace Pond/Lake Saltonstall watershed. Any change in use proposed on this property is subject to review and the approval of the Connecticut Department of Health Services (DHS).

The substation would sit partially on the existing service road (former tollgate plaza), with the rest cut into a moderately wooded hillside. There are no rock outcroppings, and the exposed earth is granular. The hillside slopes upward at 6 percent to 1 percent approximately 400 feet and is basically level onto the 115 kV feeder line (1,200 feet).

The site is located on upland, and is not in any wetland buffer zone. Location of a facility here has been determined to have no adverse impacts on surrounding wetlands or water courses. The site is not located in a floodplain. The site is shielded from the view of the closest residents by wooded area and is set back from I-95 such that existing and planned landscaping could shield the facility from passing motorists. The site is in close proximity to I-95 with associated higher road noise levels. Operational noise could affect a nearby residence. Sound absorptive barrier walls, quiet fans, or fan silencers for transformers could be used to mitigate impacts.

Amtrak, through the Joint Venture's subconsultant Parsons Brinckerhoff, conducted environmental sampling to assess the risk of petroleum products and heavy metals that may exist on the ground surface at the proposed site. Seven grab soil samples were collected. One of the samples taken adjacent to the road gave an elevated total petroleum hydrocarbon (TPH) concentration of 620 parts per million (ppm). Another sample had a TPH concentration of 190 ppm. This problem was localized, and resulted from a small amount of waste oil that was deposited there, most probably by the dumping of used automobile oil.

There are no anticipated impacts to sensitive receptors from EMF emissions at the proposed Branford site. An investigation of overall EMF impacts of the Northend Electrification can be found in Section 4.5 of this FEIS/R.

The site has low potential for containing archaeological resources. However, the 115 kV transmission line corridor may have low to moderate potential to contain either prehistoric or historic period resources, due primarily to favorable environmental factors. Since the DEIS/R, systematic subsurface testing has been conducted and no intact cultural remains were found. The site was therefore reclassified as having a low potential for archaeological sensitivity.

No impacts to wildlife or endangered species are anticipated from construction of an electrification facility at the proposed Branford site.

New Haven

The 115 kV power supply would be via a direct aerial drop from the existing United Illuminating 8300 line directly adjacent to the site. The site's land use is compatible as a substation as it is in a rail yard and is zoned industrial. Existing terrain and access would provide for ease of construction and maintenance. However, property size is restrictive due to constraints of railroad tracks, and adjustments would have to be made to existing facilities.

Transmission line reliability for Amtrak and United Illuminating customers was considered acceptable. Feeder routing would be advantageous due to the site's close proximity to the rail and existing 115 kV power supplies. There were no EMF or wildlife habitat issues, or anticipated construction impacts at the site. The site is located primarily on Amtrak property thereby making availability a non-issue.

There are no wetland issues associated with construction of an electrification facility at the site. While hazardous materials did not appear evident, the site contains a propane storage tank that would have to be relocated.

Due to its location at the end of the rail line, the New Haven site is not practical in terms of the substation separations required for the traction power supply system. Voltage levels would drop below minimum required levels between New Haven and the next proposed substation in New London. Power simulation studies conducted indicated that a fifth substation would be required in the 2 x 25 kV power supply arrangement, as well as an additional paralleling and switching station. The additional substation would be required at Old Saybrook, which would have environmental impacts as well as economic impacts far greater than if a single substation would be sufficient at Branford. Thus, the New Haven substation site was dropped from further consideration.

East River

A 6-mile underground 115 kV line would be routed along Green Hill Road from Northeast Utilities' Green Hill Substation to the site trackside. This long feeder line would have greater environmental, economic, construction, and traffic impacts than the New Haven and the proposed Branford sites.

The site's access is advantageous, and there would be no conflicts with land use of regulatory/zoning issues since the site is on former industrial plant property. The site is not located within wetlands.

Demolition of the 15,000-square-foot concrete block structure would potentially be required to accommodate the substation. However, size of parcel and access were adequate; and an alternative could be to construct the substation at the rear of the factory site.

A substation at this site would require addition of a paralleling station to the west in the vicinity of New Haven and a paralleling station to the east in the vicinity of Old Saybrook. In addition, a lengthy feeder line would be required along the track in order to optimally locate the phase break and maintain voltage levels in the traction power system.

The 6-mile 115 kV feeder line would be in close proximity to residents. This would create traffic impacts during construction along Green Hill Road and Route 79. While no EMF impacts were anticipated, the potential for exposure was greater than at either the New Haven or Branford sites.

Due to the lengthy 115 kV underground feeder line required through highways and streets in residential areas, this site was eliminated from further analysis. While trackside location of the traction power substation was considered advantageous, substation separation also meant that additional paralleling stations would be required. Overall, the potential environmental, economic, construction, and traffic impacts were greater here than at any of the other alternative Branford sites.

Madison

The site would have a similar 115 kV feeder routing as at the East River site; the distance, however, would be considerably less. A 2.5-mile underground feeder line would originate at Northeast Utilities' Green Hill Substation and run along Green Hill Road to Route 79 to the Amtrak corridor.

While the site is close to the rail line and is undeveloped land, the land is classified as inland wetland. The existing terrain would require filling of wetland area.

As with constructing a facility at the East River site, substation separation would require two additional paralleling stations in the system and lengthy feeders along the track to the phase break.

Due to the existence of wetlands, the long 2.5-mile underground 115 kV feeder line, and the additional electrical facility requirements, this site was eliminated from further consideration.

New London Area Alternative

New London

The current site is unused land adjacent to Central Vermont Railroad property. The proposed substation would be compatible with the existing rail yard. The site is zoned industrial by the City of New London such that usage would be compatible. The terrain consists of a flat gravel base with scattered areas of deteriorated blacktop. There is only minor vegetation. The site is not located in wetlands; however, it is located on the Thames River 100-year floodplain. The site would be graded above flood stage. The proposed New London site is hidden from view of any residents. With appropriate screening, the substation would not be visible by boat traffic along the Thames River.

The proposed New London site is in the Central Vermont Railroad yard, away from residential areas. The site's classification as commercial/industrial waterfront zone allows noise levels of up to 70 dBA. Noise from operational equipment in the substation would not surpass this level.

Amtrak preliminary environmental investigation identified soil on the surface that is stained extensively with ink-blue color. There are two soil/debris stockpiles in addition to some junked white goods, discarded numerous old tires and car parts, railroad ties, and extensive rolls and piles of black filter fabric. One of the soil piles in the far northeast corner of the property at the end of the east boundary fence line was covered with black stained soil that gave a very high TPH concentration of 45,000 ppm. No heavy metals were found.

There are no anticipated impacts to sensitive receptors from EMF emissions from an electrification facility at the proposed New London site or along the underground 115 kV line that runs from Northeast Utilities' Williams Street substation.

The substation site and utility corridor have a low potential for containing archaeological resources. There are no anticipated impacts to wildlife or endangered species from location of a facility at the proposed New London site.

Waterford

A 2.5-mile overhead line would run parallel to the Amtrak ROW from the site of the Waterford substation site to the Northeast Utilities' substation at Millstone Point. This bulk supply station is a 345 kV power supply and would require special consideration from the Nuclear Regulatory Commission. An advantage of utilizing this site would be its trackside location and the ability to use Amtrak's ROW for the feeder line. There would be no conflicts with land use. However, hazardous materials due to the landfill are a concern, as is the presence of wetlands. Substation separation is at an acceptable distance. Voltage levels in power simulations indicate that an additional paralleling station would be required on the Groton side of the Thames.

While the substation site would be available at a fair market price, the interconnection at Millstone Point would require a lengthy procedure with Northeast Utilities and the Nuclear Regulatory Commission.

Due to the lengthy overhead feeder line, the difficulty of tapping into a 345 kV power supply, the presence of wetlands, and possible soil contamination, this site was rejected from further consideration. Overall, the potential environmental, economic, and construction impacts were greater than at the New London site.

Millstone

The site has several advantages in that it is located next to the rail line and Northeast Utilities' Millstone substation. However, as that substation is a 345 kV power supply, special permission would have to be obtained from the Nuclear Regulatory Commission to interconnect at that location. In addition, more equipment would be required to step down from 345 kV to 25 kV.

Investigation of the site indicates it is on upland, not in wetlands, and not in the 100-year floodplain. Property availability is not an issue as the site falls primarily on Amtrak property.

There were no hazardous materials apparent at this location, nor would the substation have any significant EMF, noise, construction, or wildlife habitat impacts. Reliability of service to Amtrak would be excellent, and there would be no impacts to existing CL&P customers.

Substation separation was such that voltage levels would drop below acceptable levels between Millstone and the proposed Warwick site, a distance of nearly 60 miles. Power simulations indicate that an additional power supply point would be required at Alton, RI, or two additional paralleling stations, in New London, and at another site to be determined. This indicates that environmental, economic, and construction impacts would be greater than at the New London site if Millstone were selected.

While the Millstone site has several distinct advantages, including proximity to railroad, property availability, and adjacent power supply, it was rejected from further consideration due primarily to electrical considerations. The site would necessitate additional equipment to tap into existing 345 kV power supply, as well as additional traction power facilities, and another substation or two paralleling stations This would have greater environmental, economic, and construction impacts than the proposed New London site.

SUMMARY

Table J-2 shows a comparison of the effects for all the Connecticut substation alternatives. The Branford and New London sites were selected as the preferred sites based on their superior technical advantage and their lack of environmental impact compared to the other sites that were considered.

TABLE J-2 Comparison of Alternative Substation Sites in Connecticut 2 x 25 kV system

EVALUATION CRITERIA FACTORS	PROPOSED BRANFORD SITE	ALTERNATIVE NEW HAVEN SITE	ALTERNATIVE EAST RIVER SITE	ALTERNATIVE MADISON SITE	PROPOSED NEW LONDON SITE	ALTERNATIVE WATERFORD SITE	ALTERNATIVE MILLSTONE SITE
115 kV Transmission Line Proximity	(1,500 feet) good	(direct aerial drop) excellent	(6 miles) poor	(2.5 miles) poor	(0.75 mile) acceptable	(2.4 miles (345 kV)) unacceptable	(direct aerial drop (345kV)) unacceptable
Land Use	no conflict	no conflict	no conflict	no conflict	no conflict	no conflict	no conflict
Regulatory/Zoning	requires action	no conflict	no conflict	no conflict	no conflict	requires action	no conflict
Existing Terrain	acceptable	good	acceptable (requires demolition)	poor (requires fill)	acceptable	acceptable	acceptable
Size	good	poor	acceptable	acceptable	acceptable	acceptable	acceptable
Access	good	good	good	good	good	good	good
Substation Separation	good	unacceptable	poor	poor	good	poor	poor
Load Proximity	good	excellent	poor	poor	excellent	excellent	excellent
Feeder Routing	acceptable	excellent	poor	poor	acceptable	acceptable	excellent
Water Issues	no impact	no impact	no impact	major impact (existing wetlands)	minor impact (major flood plain)	minor impacts	no conflict
Visual/Aesthetics	minor impact	no impact	no impact	minor impact	minor impact	no impact	no impact
Noise	minor impact	no impact	no impact	no impact	no impact	no impact	no impact
Hazardous Materials	none	requires mitigation	none	none	acceptable	requires investigation	none
Transmission Line Reliability - Amtrak/Existing Customer	excellent	excellent	good	good	excellent	excellent	excellent

TABLE J-2 Comparison of Alternative Substation Sites in Connecticut 2 x 25 kV system (Continued)

EVALUATION CRITERIA FACTORS	PROPOSED BRANFORD SITE	ALTERNATIVE NEW HAVEN SITE	ALTERNATIVE EAST RIVER SITE	ALTERNATIVE MADISON SITE	PROPOSED NEW LONDON SITE	ALTERNATIVE WATERFORD SITE	ALTERNATIVE MILLSTONE SITE
EMF Proximity To Sensitive Receptors	no impact	no impact	no impact	no impact	no impact	no impact	no impact
Impacts To Historical Resources	minor impacts requires further investigation	no impact	no impact	no impacts	no impact	no impact	no impact
Construction Impacts	minor impact	minor impact	major impact	major impact	minor impact	no impact	no impact
Availability	yes	yes	yes	yes	yes	yes	uncertain requires NRC permission
Vandalism	no impact	no impact	no impact	no impact	no impact	no impact	no impact
Wildlife Habitat Impacts	no impact	no impact	no impact	no impact	no impact	no impact	no impact

Ratings:

Ratings:	Excellent	No impact/no conflict
	Good	Minor impact
	Acceptable	Major impact
	Poor	
	Unacceptable	

Source: Roy F. Weston, Inc., 1994

♦ Appendix K

Siting Analysis for Roxbury Substation Alternatives

APPENDIX K
SITING ANALYSIS
FOR ROXBURY SUBSTATION ALTERNATIVES

The placement of electrical substations for the proposed project is heavily dependent on certain critical technical considerations. When selecting potential substation locations, Amtrak initially examined proximity to a 115 kV power source. Another element was the reliability of the power source. In other words, the power source could not be tapped by any other users, thus insuring a constant, reliable source which would be unaffected by other users, and vice-versa. The third consideration was distance between substations, or in the case of the Massachusetts substation, distance from the end of the line, South Station. The final element is identification of vacant or available land adjacent to the ROW. The results of the Massachusetts substation technical site evaluation, allowing for these conditions, are shown in Table K-1.

TABLE K-1 Massachusetts Substation Alternatives

SITE	MILEPOST	LOCATION
Canton	212.90	Canton, MA
Hyde Park	220.50	Boston, MA
Clarendon Hills	221.80	Boston, MA
Terrace Street	225.20	Boston, MA
Roxbury Crossing	226.02	Boston, MA
South Station	228.80	Boston, MA

Source: Morrison Knudsen/L.K. Comstock/Spie Group and DMJM/Harris, 1994

Further evaluation by Amtrak resulted in the selection of the Roxbury Crossing site as the preferred alternative. Based on this selection, the DEIS/R evaluated this Massachusetts substation site only, a summary of which is contained in Chapter 2 of this FEIS/R. Due to comments submitted by the Massachusetts Executive Office of Environmental Affairs, a comprehensive discussion of the substation alternatives was determined necessary. The Canton and South Station alternatives, listed above, have been ruled out as alternatives due to technical considerations. The remaining sites are discussed below (see Figure K-1).

AFFECTED ENVIRONMENT

Land Use and Regulation

This section discusses the existing land use characteristics and zoning of the substation alternatives. The information presented is based on the Boston Redevelopment Authority Zoning Map, as amended.

PROPOSED SUBSTATION SITES

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure K-1

Hyde Park. This site, located at MP 220.50, is situated in the Hyde Park Industrial Center off Hyde Park Avenue in Boston. The site is located south of the Acme Industrial Equipment Company on a vacant parcel adjacent to the rail line. The site is currently utilized for storage of small amounts of fill and other materials. The surrounding area contains light manufacturing, commercial and business uses, and vacant land. The Hyde Park site is located within a light manufacturing zone (M-1).[1]

The corresponding utility corridor for this site would consist of a 1.5-mile underground feeder along Hyde Park Avenue to the existing Boston Edison 115 kV line in the vicinity of the Hyde Park Commuter Rail Station.

Clarendon Hills. This site, located at MP 221.80, would be located on an undeveloped parcel next to the rail ROW and a pedestrian overpass near the intersection of Metropolitan Avenue and Dale Street. The site is situated west and northwest of the Dale Street Park (Commonwealth of Massachusetts) and Sherrin Street Park (City of Boston), respectively. While this area is zoned for two-family residential development (R-.5), the majority of the homes located directly north of the site are single family in nature.

The site currently contains a 40-foot sewer easement which runs parallel to the NEC.[2] Amtrak would be required to work with the Boston Water and Sewer Commission prior to construction of a facility on this site. In addition, a plan to construct residential development on this parcel is currently under review by the Massachusetts Executive Office of Transportation and Construction.[3]

Because of its forested character, the site was screened for wildlife habitat value and the existence of endangered species.[4] Although the potential for the existence of endangered species was very low, and the overall impact to wildlife habitat would be minimal, this area is still considered a valuable urban wild area by the City of Boston Environment Department.

There are two potential underground utility corridor routes. One would cross the tracks and travel north, along the ROW, for approximately 1,200 feet to the existing Boston Edison Company substation north of Metropolitan Avenue. The other would travel west, within Dale Street, for approximately 2,000 feet to connect to an existing underground 115 kV line at Maynard Street.

Terrace Street. This site, located at MP 225.20, is situated in the Mission Hill area of Boston off Tremont Street. The site is located inside the vacant Oliver Ditson Building on Terrace Street in Boston. The building is currently vacant and is located among a mix of industrial and residential uses. The Terrace Street site is located within a light manufacturing zone (M-2).

The corresponding utility corridor for this site would consist of a 0.5-mile underground feeder along Terrace Street to an existing 115 kV line in Tremont Street.

Although no design is currently available, some difficulties are anticipated in retrofitting this building. The building would have to be updated for codes and substation structural needs. Systems unique to indoor substations would include fire suppression equipment, fire walls, personnel protection, smoke removal systems, evacuation facilities, lighting systems, and other safety apparatus. Given space constraints it is possible that an additional deck would be needed on top of the building. The typical floor height for an indoor substation is 30 feet; therefore, at least three substation floors could be needed. Placement of the 115 kV substation in a confined, enclosed space could require Gas Insulated Switchgear, which would make this facility unique, requiring atypical parts, maintenance equipment, and personnel training. Although the feeder route for this site is only 0.5 mile long, a redundant backup system would require approximately 2.0 miles of feeder wire, or four 0.5-mile wires.[5] This could have an negative impact on system performance.

In addition, the building is located in a Boston Landmarks Commission Historic District. Constructed in 1925, this building has been considered as making a significant contribution to the historic character of the district and modifications could be subject to historic regulation. Further, any modifications to the building could be subject to review and approval of the Boston Landmarks Commission and/or State Historic Preservation Officer.

Roxbury Crossing. This site, located at MP 226.02, is situated in an industrial district, would be located on a primarily undeveloped site, with the exception of an existing pumping station. The site is abutted by: Gurney Street to the north; the railroad to the south; Tremont Street to the east; and Station Street to the west. Uses directly abutting the site are industrial and commercial with residential uses beyond.

The corresponding 300-foot underground utility corridor would traverse the site southward and connect directly with an existing 115 kV line located in Tremont Street.

Socioeconomics

Real Estate Values. As stated in Chapter 4 of this FEIS/R, no evidence was found that stated property values would be impacted by electrical substations. Since most sites are situated in industrial areas, or would be well buffered from residential or other sensitive receptors, it is anticipated that none of these sites would have an impact on surrounding real estate values. The Clarendon Hills site, however, which is the closest to residential uses and recreational sensitive receptors, should not have an impact on these uses if effectively buffered from them.

Tax Revenues. None of the sites would be expected to impact nearby property values. As Amtrak is exempt from local taxation,[6] taxes would no longer be collected on the property selected for substation placement, although this would have an insignificant impact on municipal tax revenues.

Minority Populations. As stated above, the four sites are located in various environments. Table K-2 displays median household income and race distribution for each alternative. The information provided was compiled from Census Bureau data for each location.

Because the area of each census tract is not geographically consistent, only general comparisons can be made. As indicated, the Roxbury Crossing site has the lowest median income and the Terrace Street site has the highest minority population.

Visual Resources.
Hyde Park: This site is completely surrounded by industrial and commercial uses and a substation at this location would not visually impact surrounding areas.

Clarendon Hills: Since the site is south of residential uses (and a pedestrian overpass) some type of screening would be necessary to shield the facility from these uses. Because recreational uses are buffered from the site by vegetation, these uses would not be impacted if a vegetative buffer was maintained.

Terrace Street: Due to the fact that the proposed facility would be located inside an existing building, no visual impacts would be expected.

Roxbury Crossing: Although this site is adjacent to the tracks and located in an industrial district, a substation at this location would not be consistent with the character of the surrounding area.

TABLE K-2 Census Information for Potential Substation Sites

SITE	POPULATION	MEDIAN INCOME	RACE BY %	
Hyde Park	5,407	$26,440	White	71.4
			Black	24.1
			Amer. Indian	0.2
			Asian, Pac. Isl.	0.9
			Other Race	3.3
Clarendon Hills	8,037	33,664	White	84.0
			Black	11.2
			Amer. Indian	0.2
			Asian, Pac. Isl.	1.8
			Other Race	2.8
Terrace Street	1,818	$26,250	White	22.5
			Black	68.4
			Amer. Indian	0.2
			Asian, Pac. Isl.	0.4
			Other Race	8.5
Roxbury Crossing	2,736	$16,654	White	13.4
			Black	38.1
			Amer. Indian	0.4
			Asian, Pac. Isl.	1.9
			Other Race	46.2

Note: Percentages may not total 100 due to rounding.

Source: Massachusetts State Data Center, 1994

Electromagnetic Fields and Interference

Potential Population Exposure to Electromagnetic Field. In response to concerns raised regarding the proposed location of the substation in Roxbury, three alternative locations for that substation have been identified. Two alternative locations, Hyde Park and Terrace Street, and the Roxbury Crossing site have been evaluated in terms of the number of people residing and working in the three distance zones surrounding each location. A discussion on the alternative locations is presented below. Current populations potentially exposed to EMF resulting from the location have been based on visual assessments or, if the potentially affected area was large, on zoning criteria. Future populations were then calculated based on Massachusetts projected growth rate of 6.4 percent presented in the 1990 United States Census.

The Clarendon Hills substation was not evaluated in this manner due to its recent addition to the environmental study. Further quantitative assessment would be conducted by FRA prior to selection of the preferred alternative. Meanwhile, assumptions of population exposure have been made based on a field assessment of residences in close proximity to the substation site and utility feed routes.

Hyde Park: The Hyde Park alternative substation location is located west of Hyde Park Avenue, slightly north of Dacy Street. Adjacent to the site are several industrial buildings and a multifamily residence. The substation would require a 115 kV feeder line which would extend north along Hyde Park Avenue approximately 11,000 feet to the existing Boston Edison 115 kV power source. Due to the length of the feeder line and the densely populated neighborhoods, a significant increase in the population potential exposed to EMF would result from placing the substation at this alternative location.

Because a large area potentially would be affected by this alternative, population estimates were established via zoning criteria. The method used was similar to that described in the Technical Study on EMF in the DEIS/R. Due to power requirements, it is expected that this alternative location would require paralleling stations at the proposed Roxbury site and the alternate South Station site. The populations associated with these other sites are not included in the population estimates for this alternative. The numbers of potentially exposed persons around the Hyde Park alternative location are shown in Table K-3.

Clarendon Hills: As this site was recently introduced into the analysis, a quantitative population assessment has not yet been performed. However, given the character of the surrounding areas some general assumptions can be made. Since the facility would be located in a primarily urban and very developed area, future exposed populations would likely not change significantly from those which are existing. Also, given the existence of parkland nearby, a notable number of exposures would be classified as short-term, or occasional, as are discussed in Section 4.5 of this FEIS/R.

A field inspection of the area was conducted to estimate the number of residences in close proximity to the substation and alternative utility feed routes. The substation would not be within 150 feet of the closest residences. The two utility feed routes, however, would be within range, with the Dale Street route adjacent to approximately 40 residences and the ROW route adjacent to approximately 6 residences.

Terrace Street: According to the latest design information provided, the Terrace Street alternative substation location is located at the southern end of Terrace Street at the intersection of Terrace Place. It is our current understanding that the final location of this alternative substation has not been decided, and may be either in an abandoned factory on the east side of Terrace Street or in a parking lot across the street from the abandoned factory. Current population estimates assume that the abandoned factory would be utilized for the substation and, therefore, would not be occupied. The feeder is anticipated to tie into Boston Edison on Tremont Street approximately 2,000 feet to the north. Population estimates are based on an inspection of the area and aerial photographs. The numbers of potentially exposed persons around the Terrace Street alternative location are shown in Table K-3.

Roxbury Crossing: The numbers of potentially exposed persons around the MBTA substation and the proposed Amtrak substation have been estimated in accordance with the procedures and exposure zones established in the DEIS/R. The three zones represent the areas 0 to 50 feet (Zone 1), 50 to 100 feet (Zone 2), and 100 to 150 feet (Zone 3) away from the boundary of the proposed Amtrak substation. The projected values are for the year 2010. The results are summarized in Table K-3.

Substation Measurements

In response to comments received by FRA regarding the DEIS/R for the Northeast Corridor Improvement Project, Electrification - New Haven, CT, to Boston, MA, a measurement survey was conducted of 60 hertz (Hz) magnetic fields (EMF) in the immediate vicinity of an MBTA electric substation on Halleck Street in Roxbury (Boston), MA.

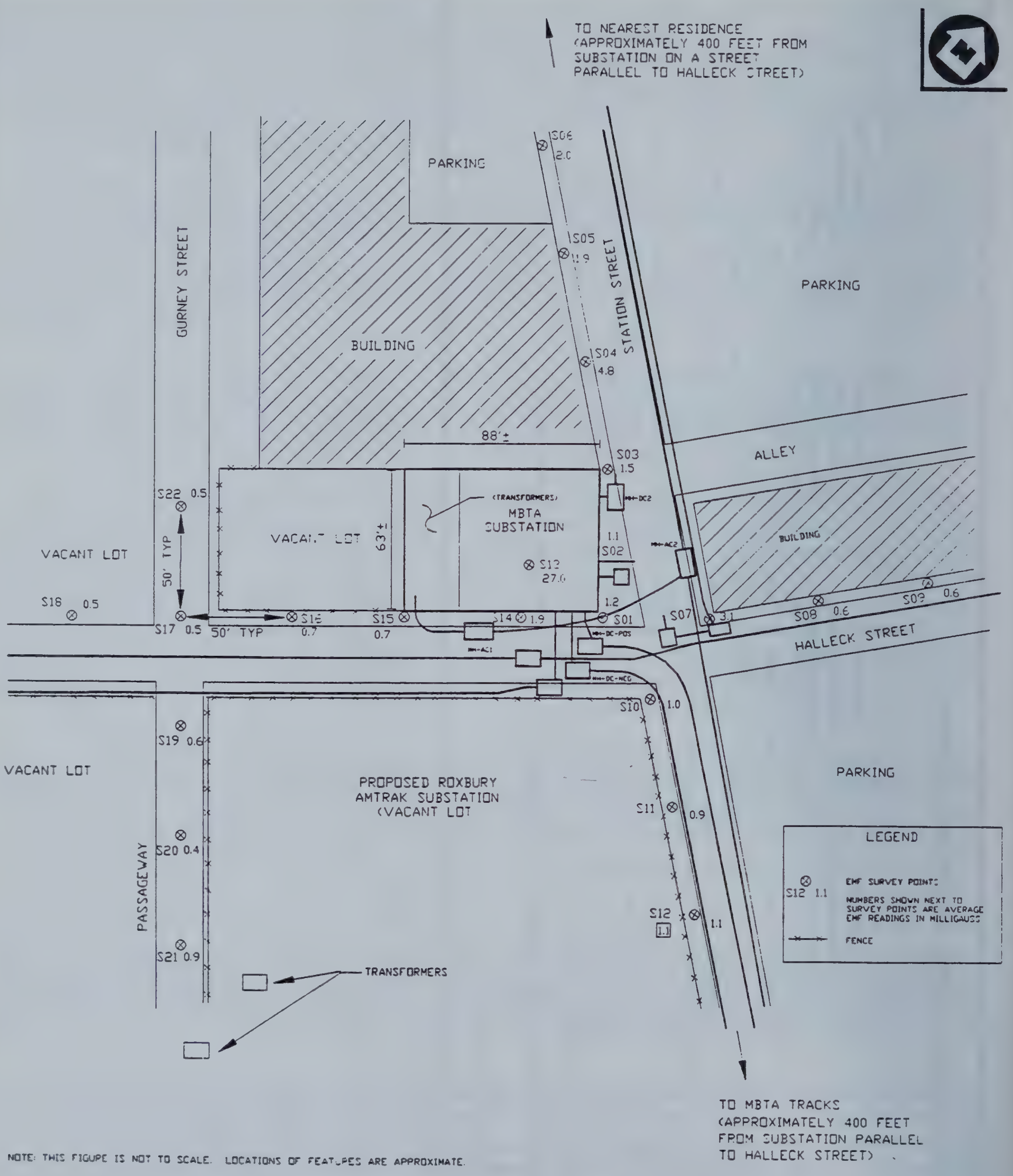
The comments relate to the location of a proposed substation for the electrification of the Amtrak rail line. The location is a vacant lot directly across Halleck Street from the MBTA substation. Commenters expressed concerns that two substations in close proximity might represent a high EMF burden to their environs. The results of the survey, in conjunction with EMF projections for the proposed substation, will be used to address these concerns.

TABLE K-3 Affected Population at Proposed Substation Locations

	CURRENT COMMERCIAL/ INDUSTRIAL			PROJECTED COMMERCIAL/ INDUSTRIAL			CURRENT RESIDENTIAL POPULATION			PROJECTED RESIDENTIAL POPULATION		
SITE	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Hyde Park	25	529	529	27	563	563	130	260	260	139	277	277
Clarendon Hills[1]	-	-	-	-	-	-	-	-	-	-	-	-
Terrace Street	24	48	48	26	51	51	18	36	36	19	38	38
Roxbury Crossing	2	8	8	3	9	9	0	0	0	0	0	0

Note: [1] Quantitative assessment will be conducted by FRA prior to selection of the preferred alternative.

Source: Roy F. Weston, Inc., 1994



Source: Roy F. Weston, Inc.

ROXBURY SUBSTATION EMF SURVEY LOCATIONS

Northeast Corridor Improvement Project
Electrification - New Haven CT to Boston MA

Figure K-2

Substation Description. The locations of the MBTA substation, the proposed Amtrak substation, and the EMF survey sites are presented in Figure K-2. The MBTA substation is a one-story concrete walled building with approximate dimensions of 60 feet (ft) along Station Street and 90 ft along Halleck Street. The building is directly attached to an adjoining warehouse to the northwest along Station Street. There are two sections to the substation, separated by an interior wall. One section is an approximate 60 ft by 60 ft square at the corner of Station Street and Halleck Street which houses rectifiers, and the other is a 20 ft by 60 ft section which houses transformers. Alternating current power input and direct current power output are by underground cables.

The MBTA substation is located in an industrial area with no residences in the immediate vicinity. A warehouse/distribution facility is located directly northwest separated from the substation by an interior wall; a distribution/manufacturing facility is located across Station Street to the northeast; and the remaining land around the substation for hundreds of feet consists of parking lots and vacant lots. The nearest residential area is approximately 300 feet to the west-northwest. The rail corridor is approximately 250 ft to the southeast, parallel to Halleck Street.

Measurement Locations, Measurement Descriptions, and Instruments Used. EMF measurements were taken at 22 locations in the vicinity of the MBTA substation and the proposed Amtrak substation site. One of the locations was inside the substation and the remainder were at accessible locations in the vicinity. A vacant lot adjoining the MBTA substation and the vacant lot that is the proposed Amtrak substation were both fenced off and therefore inaccessible.

Measurements were taken at the three accessible corners of the substation sites and at the midpoints of their two accessible walls. Measurements were also taken at measured 50-ft intervals along each of the nearby streets.

As described in great detail in the DEIS/R, EMF levels vary with the levels of electric current being drawn at a specific location at any specific time. Therefore, EMF levels change frequently in the vicinity of substations, since current loads vary when trains go by and when power use changes in local industrial facilities. In order to estimate representative conditions, EMF measurements were taken in 10-second intervals over a 5-minute duration at each survey location, except for the measurement inside the substation which was conducted at 1-second intervals over a 12-minute duration. Single points for measuring EMF were selected rather than taking measurements while moving from point to point. This was done to eliminate the uncertainty about whether changes in EMF levels were due to changes in location or the time-varying nature of the EMF. The EMF values are presented herein as discrete readings for each measurement interval and as averages over the selected time duration.

The measurements were conducted on Thursday, April 21, 1994, between 9:30 AM and 12:30 PM. Trains went by during all but two of the exterior measurements; it is not known whether trains went by during the substation interior sampling, but it is likely that they did because of the relatively long measurement duration.

An Emdex C hand-held meter was used. The Emdex C is a three-axis magnetic field data logger, which acquires 50 to 60 Hz magnetic field data. The magnetic field intensities were calculated as the root mean square of the three axial components of the magnetic fields. As with all other EMF data presented in the DEIS/R, only the magnetic field component of EMF was measured. All measurements were taken at 60 centimeters above ground level with the instrument oriented with the x axis aligned north-south, the y axis aligned vertically, and the z axis aligned east-west.

Results. The measured magnetic field intensities at each survey point are presented in Appendix 5A of Volume II of this FEIS/R in graphical form. At least 30 measurements of magnetic field intensity were taken at each location; the graphs demonstrate the significant fluctuation in field strength that takes place as the nearby sources of EMF vary with varying current.

The averages of all readings at each survey location are presented in Table K-4 and are shown on Figure K-2, next to the survey location. The values directly around the substation range from 0.7 to 1.9 mG and are generally

between 0.4 mG and 1.1 mG elsewhere, except for locations S05 and S06, which are under utility power distribution lines; S04 which is under a power distribution line and over the electric service line to the building shown on Figure K-2; and S07 whose EMF source is unknown, but may be related to an underground electric conduit at the north corner of Halleck and Station Streets.

TABLE K-4 Average Magnetic Field Intensity

LOCATION	FIELD INTENSITY (mG)	LOCATION	FIELD INTENSITY (mG)
S01	1.2	S12	1.1
S02	1.1	S13 (Inside)	27.0
S03	1.5	S14	1.9
S04	4.8	S15	0.7
S05	1.9	S16	0.7
S06	2.0	S17	0.5
S07	3.1	S18	0.5
S08	0.6	S19	0.6
S09	0.6	S20	0.4
S10	1.0	S21	0.9
S11	0.9	S22	0.5

Source: Roy F. Weston, Inc., 1994

The highest EMF values measured were at survey point S13, which exhibited an average of 27.0 mG over a 12-minute measurement period. However, this survey point was directly inside the substation and was not a location of public exposure.

The maximum instantaneous EMF measurements are shown on the graphs in Appendix 5A, Chapter 5 of Volume II. The maximum values were generally between 0.6 and 2.6 mG in the neighborhood around the substation, 2 to 5 mG on the sidewalk next to the substation, 6.5 mG at S04 (over the building utility feed line), 3.5 at S07 (across the street from the substation), and 95 at S13 (inside the substation).

Conclusions. Typical urban EMF values are reported in Volume III of the DEIS/R, Section 5.4.3 of the Technical Study for Electromagnetic Field Impacts. These were obtained from the city streets of Providence, RI, which contain representative urban-area EMF generating sources such as power distribution lines, building feed lines, signage, dedicated power lines, traffic control signals, lighting, building HVAC, and electrical motors and devices associated with office, commercial, manufacturing, and institutional use.

The Providence data over a 6-mile travel distance is presented in the DEIS/R section referenced above. The following conclusions were drawn from the data:

- the measured EMF ranges from 0 to 26 mG
- the highest sustained readings are around 10 mG; readings higher than 10 mG occurred as instantaneous "spikes" indicative of a narrow source of power such as a power line
- the average of the data appears to be around 4 mG

Based on the results of the survey described in this report, and on the Providence survey cited above and described in more detail in Volume III of the DEIS/R, the following conclusions have been reached:

- the EMF values immediately adjacent to the substation are equal to or less than EMF values elsewhere in the same neighborhood generated by other sources

- all EMF values measured (except for those measured inside the substation) have an average intensity of 1.3 mG, which is significantly lower than the 4.0 mG urban average obtained during the Providence survey

- all EMF values (except for those measured inside the substation) are within the ranges typically encountered within and around residences

- the MBTA substation has no discernible EMF levels above what would be considered background levels for either urban areas or for residential units in any setting

- the MBTA substation EMF levels would have no direct influence on the levels projected for the proposed Amtrak substation since they cannot be discerned from other background levels

This last point is critical in that it relates to the potential for combined or cumulative impacts from the existing MBTA substation and the proposed Amtrak substation, which is one of the concerns raised in comments on the DEIS/R. Since the EMF levels surrounding the MBTA substation are consistent with the levels encountered in urban environments, the EMF impacts associated with the proposed Amtrak substation would be expected to be essentially the same whether the substation were located at the proposed location near the MBTA substation or at any other location in an urban environment. Thus, no site-specific analysis of cumulative EMF impacts is warranted.

Summary of Alternatives

The alternatives are summarized by impact category in Table K-5. As indicated, all sites have shortcomings, either technical or environmental. Although the Roxbury Crossing site is technically excellent and would expose the fewest people to EMF, it would pose a visual problem and is located in a high minority, low income area. The Hyde Park site would expose the most people to EMF, and would require an extensive utility corridor, but would be environmentally sound otherwise. The Clarendon Hills site would be well suited for substation placement with proper buffers for the protection of nearby residents, recreation users, and wildlife habitat, but could be restricted by an existing sewer easement and/or existing development plan. The Terrace Street site would require extensive retrofitting if placed inside the building, but would cause relatively insignificant impacts in other areas.

TABLE K-5 Summary Matrix, Roxbury Crossing Substation Siting Alternatives Analyses

SUBSTATION CONFIGURATION			POTENTIAL IMPACTS			
Substation	**Utility Feeds/ Connections**	**Additional Facility Sites[1]**	**Land Use**	**Minority/ Low Income Populations**	**Visual**	**EMF Exposure, 2010 Population (0-150 ft)**
Roxbury Crossing	None (connection at property line/ Tremont Street)	None	None	Yes	Yes (screening required per DEIS/R)	21 (commercial)
Hyde Park	1.5-mile underground feed along Hyde Park Avenue	Roxbury, South Station	None (industrial use)	No	None	1,846 (res & comm)
Clarendon Hills	0.4 mile along Dale Street, or 0.2 mile along ROW	Roxbury, South Station	Yes - sewer easement, existing development plan under review	No	Yes - maintain vegetative buffer	Approximately 40 residences for Dale St feed; 6 residences for rail ROW feed[2]
Terrace Street	0.5 mile to Tremont Street	None	None	Yes	None (inside building)	223 (res & comm)

Note: [1] All sites require a paralleling station at Canton, the siting of which is evaluated in this FEIS/R.

[2] Qualitative assessment due to recent introduction to the environmental study.

Source: Morrison Knudsen/Comstock/Spie Group and DMJM/Harris, 1994

Endnotes

1. Boston Redevelopment Authority Zoning Map, 1994.

2. Conversation with A. Correia, Boston Water and Sewer Commission with J. Duncan, DMJM/Harris, August, 1994.

3. Conversation with A. Warren, MBTA Real Estate, with J. Duncan, DMJM/Harris, August 1994.

4. National Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, 1993.

5. Conversation with S. Gazillo, MK/LKC/Spie with J. Duncan, DMJM/Harris, 11 May 1994.

6. Rail Passenger Service Act.